TOSCO CORPORATION
AVON REFINERY
MARTINEZ, CALIFORNIA

UOP CONTINUOUS CATALYST REGENERATOR

ORDER NO AV 88892

MANUAL NO. 0007

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CAUTION! The equipment covered by this manual is of a sophisticated nature. Electrical and electronic circuits operate at various voltage levels and contain solid state components in addition to more common types of electrical gear. Maintenance and/or repair of this equipment by other than trained technicians or Montrex Service Representatives may result in damage to the instrument and/or hazard to personnel.

UOP
Des Plaines Illinois
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IMPORTANT

For replacement of all Monirex supplied parts and equipment as well as for maintenance and service please call

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A. INTRODUCTION

The UOP Monirex Continuous Catalyst Regenerator (CCR) Lock Hopper Control System Model 2000 is designed to control the safe transfer of catalyst from the Platformer reactors to the Regenerator allow the regeneration of the catalyst, and control the safe transfer of regenerated catalyst back to the Platformer reactors This is all implemented with the use of well proven highly reliable programmable controllers

THE MAJOR FEATURES OF THE SYSTEM ARE:

1 Programmable Controller incorporating non-volatile Read Only Memory enabling

   a) Control of the Catalyst flow through the Platformer and Regenerator
   b) Initiation of emergency shut-down sequence
   c) Operation of the regenerator heaters
   d) Introduction of nitrogen or air to the regenerator as necessary
   e) On/Off Control of Chloride injection into the chlorination zone of the regenerator
   f) Diagnostics for ensuring proper controller operation
   g) Indication of plant operation status on a graphic display
   h) Integrated alarm system

2 Proprietary program custom designed for specific installation

3 Safe operation utilizing

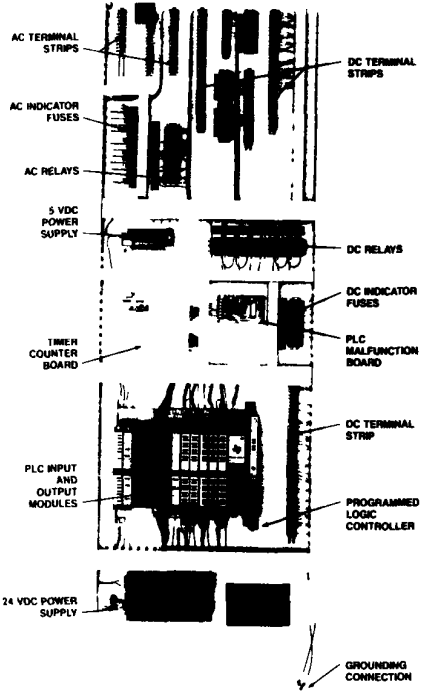
   a) Specially designed built in proprietary hardwired safety interlock system and Programmable Controller malfunction detection system.
   b) Program non-modifiable by operator

In addition to the three (3) controller backplates required to implement the aforementioned control the system has been designed to interface with user's existing display panel This existing display panel incorporates a dedicated graphic display of the process status operator control switches for controller operations shutdown bypass system controller system power distribution and an annunciator alarm system The total system is in general accordance with the UOP Project Specifications

NOTE Subject matter presented in this Manual assumes the user has a thorough understanding of the UOP CCR Platforming Process

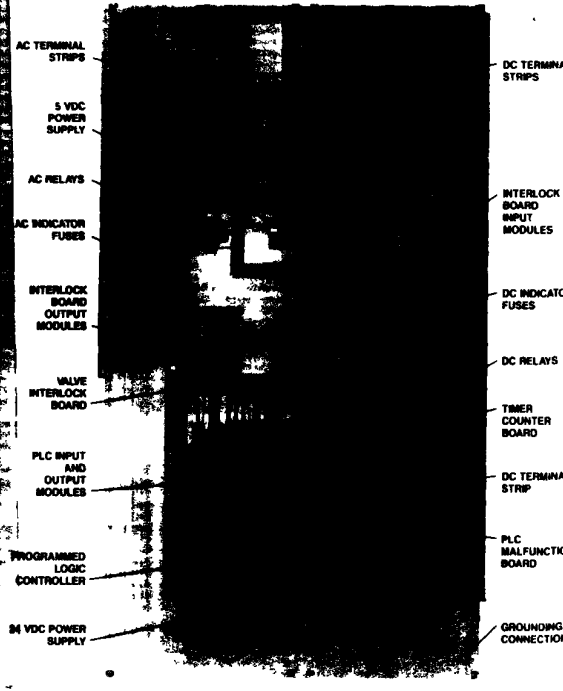
UOP MONIREX SYSTEMS
CCR LOCK HOPPER CONTROL SYSTEM
MASTER CONTROLLER

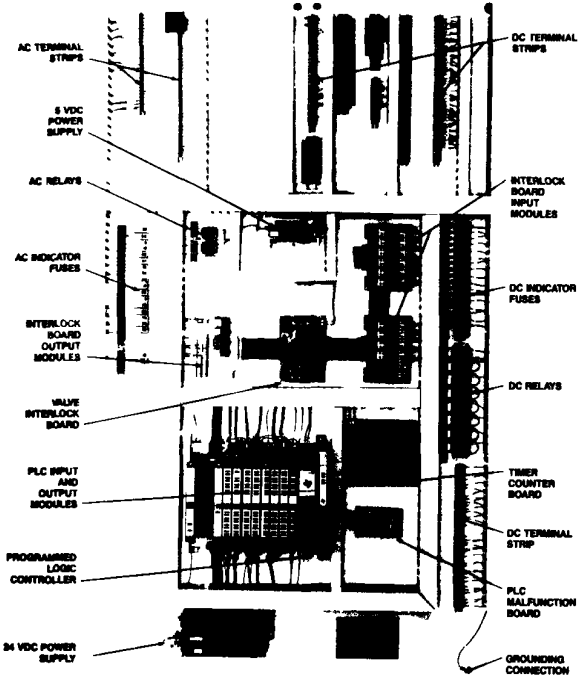
TOSCO CORPORATION
AVON REFINERY
MARTINEZ, CALIFORNIA



UOP MONIREX SYSTEMS
CCR LOCK HOPPER CONTROL SYSTEM
LOCK HOPPER NUMBER 1 CONTROLLER

TOSCO CORPORATION
AVON REFINERY
MARTINEZ, CALIFORNIA





A. CCR LHCS UNPACKING AND INSTALLATION

The master and lock hopper controller backplates are crated for air shipment (weight approximately 4 500 bs)

1 Remove all four sides of crate carefu ly Spacer and supports are added to the side to prevent damage to nstrument bezels etc Careless handling may cause damage

2 After removing the crate remove the plastic cover and Inspect for external damage to expedite damage claims and repairs

3 nspect for any Internal damage or loosened components

4 Place pane n position and bolt as required (bottom sides top)

5 Remove Styrofoam™ packing if any Check that all plug-in components are firmly seated

6 Remove desiccant blocks if present

Retrofit Subpanel Installation Guidelines

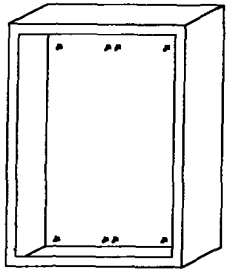


Fig 1

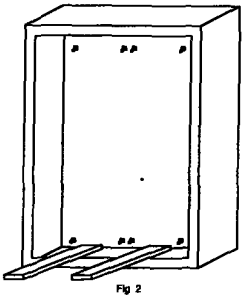


Fig 2

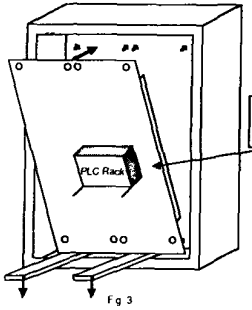


Fig 3

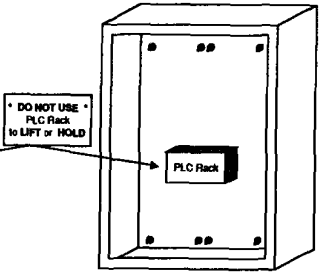


Fig 4

(Removing the cabinet doors will usually a low more room for easier installation)

1 Remove old Subpane s and se the wires aside for easy access (Fig 1)
2 S de two pieces of wood a he way o the back of the cabinet (Fig 2)
3 Place he new Subpane onto the boards and push the bottom to the back of the cabinet (Fig 3)
4 Push he top part o the Subpane to the back of the cabinet (Fig 3)
5 Push down on he boards o raise the Subpane so that the holes align with the studs (Fig 3)
6 Push the Subpane onto the s uds and secure (Fig 4)

A. OPERATION DESCRIPTION

1. LOCK HOPPER NO. 1

The normal operation of the Lock Hopper Controller is described first. Next, the Delayed Stop Sequence which is included to avoid possible damage to the ball valve seating surfaces by closing on catalyst particles, is described.

When the Lock Hopper No 1 Controller circuit breaker is closed, AC power is applied to the level switches, the 5 VDC and 24 VDC power supplies, and the programmable controller The 24 VDC power supply provides power to the lamps valve position detectors, monitor switches programmable controller DC I/O modules and the Controller Malfunction Board. The 5 VDC power supply provides power to the Controller Malfunction, Valve Interlock, and Counter/Timer Preset Boards As long as AC power is applied, these circuits are always operating and are not under the control of the process operator The Controller Failure Relay will energize if the Programmable Controller operation is satisfactory, causing the valve power and alarm contacts to close

STOP POSITION

Once logic power is established the start-stop circuit controls further application of power to the system. In the Stop position, the Valve Power Relay is not energized AC is not available to the valve solenoid output modules and all valves are de-energized (BV 1 BV 11 and BV 15 open, all others closed)

Valve Status BV 1 BV 11, BV 15 OPEN

"LH 1" Start Stop

The Emergency Stop Switch is in the "RUN" position, and the Platforming heater is operating (heater shutdown contact closed), the "LH-1" pushbutton is enabled and the controller can be started or stopped by depressing the "LH-1" pushbutton. Depressing the *pushbutton to start* the cycle, turns off the red lamp in the pushbutton, turns on the green lamp and energizes the Valve Power Relay and the controller proceeds into Step 0 At any time during the cycle when the pushbutton is depressed again, or the Platformer Heater Shutdown contact opens the system will revert to the Stop position previously described (by the delayed stop sequence if required, see description at the end of this section) The "LH-1" pushbutton is also disabled if the Platformer Heater Shutdown contact opens If the Emergency Stop Switch is set to the "STOP" position or valve power *is lost, the system will revert immediately to the Stop position* and the pushbutton is disabled

STEP 0--READY

When in Step 0 the "READY" lamp lights and BV 7 opens (BV-5 closes if returning from Step 14B) BV 1, BV 11 and BV 15 remain open This position is the normal resting step between cycles of the lock hopper and except at startup the hopper is full of catalyst and under hydrogen pressure Step 0 follows Step 14B in normal operation

Since *BV 7* was moved by a command to open in this step confirmation that the valve is open must be received before the next step can proceed BV 11 and BV 15 were not moved and

are not checked a ths po nt It is a so necessary to reset the Long Cycle Alarm Timer and to conf rm hat BV 3 and BV 5 are closed

f "LH 1" Run Hold pushbutton is in "Run" position and a Step 1 Enable signal from the lock hopper selector system is present BV 1 closes When all valve positions are confirmed correct and the Purge Counter Thumbwheel Switch s not set to zero the cycle begins

NOTE Since setting the Purge Counter Thumbwheel Switch to zero could cause a hazarous condition the system is designed so it cannot proceed to Step 1 if zero purges are selected

Valve Status BV 7 BV 11 BV 15 OPEN

STEP 1 PURGE

BV-4 and BV-9 open the "READY" lamp goes off the "PURGE" lamp lights and the Long Cycle Timer starts timing f the cycle operates as scheduled, the Long Cycle Timer will be reset in Step 0 before it times out If any malfunction causes the cycle to stop the Long Cycle Timer wi time out and open the Long Cycle Alarm contact

The lock hopper depressures to the flare system through BV-9 and when the pressure falls to the setpoint of PI 305 1 (monitor switch closed) BV-9 closes and BV-9A opens to the heater *tirebox The lock hopper* conf nues to depressure through BV-9A and when the pressure falls to the setpoint of P 305-2 (monitor switch clc sed) BV 11 closes When all valve positions are conf rmed correct the cycle proceeds to Step 2

f the cycle is stopped when the pressure is below the setpoint of PI 305-1 (monitor switch *closed) and then restarted* BV 9 will *not* open BV 9A wil open immediate y succeeding events rema n the same

Valve Status BV-4 BV 7 BV 9A BV 15 OPEN
BV 9 cyc es once closed at end of step

STEP 2 PURGE

BV 10 opens Conditions which must exist before the step proceeds are

verification sat sfied — *FI 304 low (monitor switch open)* and

P 305 2 low (mon tor switch closed)

When a these conditions are met BV 12 opens and when F 304 signals that the purge flow has risen (monitor switch closed) the Purge Timer starts timing The purge and vent restriction orifices are s zed to produce a rise n pressure during this period and the P -305 2 monitor sw ch opens When the Purge Timer times out BV 12 closes The lock hopper depressures through BV 9A and when the pressure fc s to the setpoint of PI 305 2 (monitor switch c osed the sequence repeats The Purge Counter Thumbwhee Switch can be set to any number o purge cycles from 1 to 9 When the selected number of purges are completed and a valve positions are confirmed correct the cycle proceeds

The open position o BV 12 is not conf rmed directly the open position is confirmed by the flow ndication on FI 304 (mon tor switch closed)

The condition above that F 304 indicates a low flow is used for the operations check of the npu c rcuit A th s po nt in the cycle with EV 12 closed the actua flow must be zero If the transmitter or nput c rcuit fa s with a high output indicating a flow the cycle will stop and the Long Cycle Alarm contact wT open when the Long Cycle *Timer times out If the transmitter or* nput circu t fa ls with a low output BV 12 w open but no flow will be indicated the Purge

Timer will not start timing and again the cycle will stop and the Long Cycle Alarm contact w ll open The circuit is therefore checked against a failure in either direction

Valve Status BV-4, BV 7, BV-9A, BV 10 BV 15 OPEN
BV 12 open in subroutine closed at the end of step

STEP 3—PURGE

BV 9A, BV 10 and BV 15 close The cycle proceeds when the valves have closed *and all* valve positions are confirmed correct

Valve Status BV-4 BV 7 OPEN

STEP 4—UNLOAD

BV 11 opens and then BV 14 and BV 16 open the "PURGE" lamp goes off and the "UNLOAD" lamp lights The cycle proceeds when all valve positions are confirmed correct and a Step 5 Enable signal is received from the Lift Gas nterlock circuit in the Master Contro ler (see Master Controller discussion)

Valve Status BV-4 BV 7 BV 11 BV 14 BV 16 OPEN

STEP 5—UNLOAD

Note The operation of the Delayed Stop circuitry is described later

BV 13 opens The Unload Timer starts timing when the valve is verified open The cycle *proceeds after the timer times out.*

Valve Status BV-4 BV 7 BV 11 BV 13 BV 14 BV 16 OPEN

STEP 6A—UNLOAD

BV 13 closes The Dust Settling Timer starts when the valve is closed The cycle proceeds after the timer times out

Valve Status BV-4 BV 7 BV 11 Bv 14 BV 16 OPEN

STEP 6B UNLOAD

BV 14 closes After 10 seconds and all valve positions are confirmed correct the cycle proceeds

Valve Status BV-4 BV 7 BV 11 BV 16 OPEN

STEP 7 UNLOAD

BV 16 closes and the Transfer Counter for Lift Engager No 1 advances one digit The Abnormal Loading Alarm lt in an alarm condition is reset (see Step 13) The Step 7 signal s sent to the Reactor Level Circuit in the Lock Hopper No 2 Controller (see Lock Hopper No 2 Controller Reactor Leve Circuit discussion) The cycle proceeds when al va ve positions are conf rmed correct

f the system is stopped after unload Step 7 but before Step 13 the Transfer Counter w not ncrement n the next cycle n th s way the counts and the actua amount of cata yst transferred rema n the same (If however the system is stopped after unload Step 7 but before Step 13 and the power is turned off the counter will ncrement n the next cycle even

though no catalyst is unloaded causing an error between counts and the actual amount of catalyst transferred)

Valve Status BV-4 BV 7, BV 11 OPEN

STEP 8—PRESSURE

BV 15 opens and BV-4 and BV 7 close The "UNLOAD" lamp goes off and the "PRESSURE" lamp lights When all valve positions are confirmed correct the cycle proceeds.

Valve Status BV 11 BV 15 OPEN

STEP 9—PRESSURE

BV-8 opens If PDI-303 indicates a low differential pressure (monitor switch open), FIAL-302 has indicated a flow (monitor switch closed) for 15 minutes, and if all valve positions are confirmed correct, then the cycle proceeds

The performance of the PDI-303 input is checked in Steps 9 and 10 A low signal is required before Step 10 can start and a high signal is required before Step 11 can start. A failure in either direction will cause the Long Cycle Alarm contact to open after the Long Cycle Timer times out

Valve Status BV-8 BV 11, BV 15 OPEN

STEP 10—PRESSURE

BV 1 BV 5 and BV-6 open When the valves are open and the lock hopper pressure has risen to essentially the same pressure as the Catalyst Collector as indicated by PDI-303 (monitor switch closed) and all valve positions are confirmed correct the cycle proceeds.

BV 5 in the catalyst line is opened to allow pressure to build in the transfer line between BV-3 and BV 5 Vee-ball BV 2 allows pressure past the ball At the end of the step, the only part of the system which is not equalized in pressure is the body and ball cavity of BV-3 This minimizes abrupt pressure changes in the line

Valve Status BV 1 BV 5 BV-6, BV 8 BV 11, BV 15 OPEN

STEP 11 PRESSURE

BV-6 and BV-8 close If L 307 is low (level switch closed) and if PI-305-1 and PI-305-2 are high (monitor switches open) when the valves are closed the cycle proceeds

n this step the LI-307 low output and the PI-305-1 and PI-305-2 high outputs are checked The level indication should be low since the lock hopper was unloaded in Step 5 If the ndication is high either the LI-307 circuit has failed or the unloading line is plugged and the hopper actually did not unload If the LI-307 circuit fails and gives a false low level indication the fa lure will cause the Abnormal Loading Alarm contact to open in Step 13

The P 305 1 P 305 2 high outputs are checked in this step the low outputs are checked in Step 1

Va ve Status BV 1 BV 5 BV 11 BV 15 OPEN

STEP 12—LOAD

BV-3 opens, the "PRESSURE" lamp goes off and the "LOAD" lamp lights When all valve positions are confirmed correct the cycle proceeds

Valve Status BV 1 BV-3 BV-5, BV 11 BV 15 OPEN.

STEP 13—LOAD

Note The operation of the Delayed Stop circuitry is described later

BV-2 opens and the Abnormal Loading Minimum Timer starts timing. The Abnormal Loading Range Timer starts timing when the Abnormal Loading Minimum Timer times out. These timers will be set in the field so that the Minimum Timer times out shortly before the normal fill time and the Range Timer times out shortly after If LI-307 indicates the hopper is full (level switch open) after the Minimum Timer times out and before the Range Timer times out, the loading is normal If the Minimum Timer does not time out before the level switch opens, either the flow pattern is abnormal or LI-307 has failed. An abnormal flow pattern can result from either an incorrect differential pressure or a plugged catalyst line In either case, the Abnormal Loading Alarm contact opens. The Abnormal Loading Alarm condition is retained until Step 7 of the next cycle

Normally the end of the step is signaled by LI-307 (level switch open) and the cycle proceeds If the Range Timer times out and a level signal has not appeared, the end of the step is signaled by the timer (A low level and Step 14A together will also give an Abnormal Loading Alarm)

The open position of BV 2 is not confirmed and verification is not required in proceeding to Step 14A. This reduces the possibility of stopping the cycle with BV 2 open and subsequently closing BV-3 and BV-5 on catalyst particles.

Va lve Status. BV 1 BV-2, BV-3 BV-5, BV 11, BV-15 OPEN

STEP 14A—LOAD

BV 2 closes The Dust Settling Timer starts timing when the valve is closed The cycle proceeds after the timer times out and all valve positions are confirmed correct However, if LI 307 indicates a low level (level switch closed) the Abnormal Loading Alarm contact opens

Valve Status BV 1 BV-3 BV 5, BV 11 BV-15 OPEN

STEP 14B—LOAD

BV 3 closes After a 10 second delay and all valve positions are confirmed correct the cycle is complete

Valve Status· BV 1 BV 5 BV 11 BV 15 OPEN

When this step is complete the Long Cycle Timer is reset

n normal operation the system returns to Step 0, wherein BV-5 closes However when the logic has determined that either BV 12 or BV 14 are leaking, the system proceeds to Step 15A

4 5 9 3 4 0 4 1 0 0 7

STEP 15A LEAK CHECK

BV 5 closes When all valve positions are confirmed correct the cycle proceeds

Va ve Status BV 1 BV 11 BV 15 OPEN

STEP 15B LEAK CHECK

BV 15 closes for 15 seconds

Va ve Status BV 1 BV 11 OPEN

When this step is complete BV 15 opens and the system returns to Step 0

b DELAYED STOP SEQUENCE

When the operator pushes the "LH 1" pushbutton to stop the system, the red lamp in the pushbutton lights mmediately to acknowledge the operator's action However if the system goes nto the De ayed Stop Sequence the green lamp remains on until the sequence is *complete Likewise the* Valve Power Relay remains energized during this period to supply power to the va ves

The system w ll *return to the Stop position previously* described) if the "LH 1" pushbutton is pushed at any t me in the cycle except Steps 5 6A 6B 13 14A or 14B If the cycle is in Unload S ep 5 6A, 6B or Load Step 13 14A, or 14B closing of catalyst valves BV 14 and BV 1o or BV 3 and BV 5 is delayed unt l *the dust settling steps have been completed*

If the cycle is n Step 5 when the "LH 1" pushbutton is depressed the Unload Timer is bypassed and the cycle proceeds into Step 6A in which the *Unload Vee-ball BV 13 closes and* the Dust Sett ng Timer starts The system returns to the Stop position when Step 6B is comple ed *The cycle being in Step 6A or 6B when* the "LH 1" pushbutton is depressed the sys em comp etes Step 6B resets the Long Cycle Timer and then returns to the Stop position The system can not be restarted until it has returned to the Stop position

The delayed stop in Steps 13 14A and 14B is similar If the "LH-1" pushbutton is depressed in S ep 13 the lock hopper moves mmed ately nto Step 14A bypass ng LI 307 and the Abnormal Load ng T mer The system returns to *the Stop position when* Step 14B is completed The cycle be ng in Step 14A or 14B when the "LH 1" pushbutton is depressed the system completes Step 14B resets the Long Cycle Timer and then returns to the Stop position The system can not be restarted until it has returned to *the Stop position*

I the Platforming Heater Shutdown contact opens while the system is in Steps 5 6A 6B 13 14A or 14B the de ayed stop function wi l operate normally If the "EMERGENCY STOP" sw tch s turned to the "Stop" position a va ves will immediate y go to the de-energized pos tion

c VERIFICATION

One o the Programmable Controller functions which is ncluded to insure the safety of the system, is a verification network which compares the output of *the command matrix (before* the interlock system) with the valve position sensor signals All cycling of the system stops if the verification network is not satisfied and after a short delay the Verification Alarm contact opens

The network checks each valve to see that the position sensor circuit which is energized corresponds to the valve command, open or closed It double checks to see that the opposite position sensor is not energized In this manner discrepancies either in valve position or in position sensor function will be alarmed

A momentary valve position discrepancy occurs each time a valve command is changed and lasts until the valve reaches its new position The Verification Alarm Timer will start timing and if *the discrepancy lasts longer than the time normally* required for valve movement the timer will time out and open the Verification Alarm contact

Verification is not used to inhibit advance between Steps 13 and 14A.

d *CONTROLLER* MALFUNCTION BOARD

The Controller Malfunction Board is provided to ensure the integrity of the programmable controller *This board consist of a single chip microcontroller* an optically isolated input several status LEDs and a solid state relay It controls the operation of the Controller Failure Relay in each contro er and output of the Enable signals in the Master and Lock Hopper No 2 Controllers Both *5 VDC logic power and 24 VDC to drive the relays,* are required A green "POWER" LED is provided to show when logic power (5 VDC) is present

The programmable controller outputs a 24 Volt zero to peak *Square Wave of set frequency and* duty cycle, called the Heartbeat signa to the Controller Malfunction Board The Heartbeat is *first optically isolated and then the* isolated signal lights the "HB-IN" LED and goes to the microcontroller input port One function of the microcontroller is to invert the Heartbeat signal and drive the "HB-OUT" LED thereby providing proof that the microcontroller is receiving the Heartbeat signal correctly

When the Controller System is first powered up the Controller Malfunction Board ensures that the Controller Failure Relay and Enable signals *are de-energized The microcontroller* waits unt the Heartbeat signa is of the proper frequency and duty cycle and then energizes the solid state relay output and lights the "ENERG" LED The solid state relay output s used to energ ze the Contro ler Failure Relay (and allow Enable signals *from the Master and Lock* Hopper No 2 Controllers) The microcontroller then continues to monitor the Heartbeat for abnormalities If the Heartbeat becomes erratic or stops completely then the fo low ng w ll occur

> The "FAULT" LED w ll light *The solid state relay* output will de energ ze and the "ENERG" LED will go out The Controller Failure Re ay contacts will open dropping the AC power to the Valve Solenoid Output Modules and causing a Controller Failure Alarm (An analogous alarm occurring in either *Master or Lock Hopper No 2 Controller will also* drop the Enable signals to the Lock Hopper No 1 Controller causing Lock Hopper No 1 tc hold at the end of its cycle This will allow the catalyst evel in the Platformer Reactor to be ma nta ned Also the regenerator heater relays in the *Master Controller* w de energize shutt ng down the heaters)

The Contro ler Maltunction Board wil hold in this step indefinitely Once the problem with the programmable controller has been corrected the Board can be reset by cycling the power to it

• VALVE LEAK DETERMINATION AID

Monirex has implemented valve leak determination in the CCR Lock Hopper Control System program logic for Lock Hopper No 1 and No. 2 Controllers The logic is based on the valve leak determination analysis found in the "General Manual of Operation, UOP Platforming Catalyst Section Single Transfer System"

The valve leak determination is divided into four independent sections based upon a specific bleeder vent high flow alarm as shown in the table attached The leaking valve is determined by monitoring selected lock hopper cycle steps in which a bleeder vent high flow alarm occurs Once an alarm has been indicated it is necessary to monitor the alarm status during a complete lock hopper cycle Throughout the following cycle, the active command light will flash of the valve determined to be leaking No additional valve leak detection alarm is used.

It is important to note that the system logic design in each section will only determine one valve leak at a time except in the case of valves 12 and 14 In this case we are programming two additional steps STEP 15A and STEP 15B at the end of the Lock Hopper No 1 cycle, activating only when the logic has determined either BV 12 or BV 14 to be leaking. Step 15A will close BV 5 the same as if the cycle were to proceed from Step 14B to Step 0 in a normal cycle Then Step 15B will close the nitrogen bleeder vent BV 15 for a period of 15 seconds If FIAH-308 disappears, BV 14 is leaking, if not then BV 12 is leaking. BV 15 would then be opened and the cycle would proceed. Further the logic is premised on valve seats being properly adjusted to prevent low pressure leakage Valve leakage determined is occurring at high pressure do to wear of the valve If after the system indicates the same valve to be leaking in four consecutive cycles the operator can be reasonably sure that a specific valve is leaking.

New or replacement systems will require the high flow contact input (Inlet Bleeder Vent FIAH 318 and F AH 342 Bleeder Vent FIAH-308 and FIAH-348) into the lock hopper controller cabinets Each of the four signals has a time delay adjustable from 0 to 30 seconds. The times are adjusted by the respective thumbwheel switch located on the Timer Counter/Board in the associated lock hopper controller The Timer Range Alarm will be activated if the thumbwheel value is set above 30 seconds and a default value of 30 seconds will be used. After the time delay the controller begins the valve detection logic and will drive the high flow alarm signal to the Monrex display panel annunciator On replacement systems the customer will have to rew re the high flow contacts from the annunciator to the controller cabinets and set the annunciator time delay to zero or use a non-time delay circuit As an alternate, on replacement systems where the customer does not desire to rewire he will have to add an extra set of contact inputs to the controller cabinets Further the high flow alarm will not be driven from the lock hopper controller and the associated time delays in both the annunciator and controllers w ll have to be set independently

As a final note the leak determination implemented is an aid and is not foolproof If more than one valve is leaking or in the case of a low pressure valve leakage either an incorrect valve or no valve may be indicated

LH-1 LEAK DETERMINATION

STEP STATUS

VALVE	1	5	13	
3	L	L		FIAH
4			L	-318
5	L			

	1	2	5	10	13	15B	
6	L	L	L				
7				L			
8	L						
10	L		L	L	L		FIAH
11		L					-308
12	L			L	L	L	
14	L			L	L		
15			L				
16	L	L		L	L		

LH-2 LEAK DETERMINATION

STEP STATUS

VALVE	2	8	15	
43	L	L		FIAH
44			L	-342
45		L		

	2	5	8	11	15	
46	L		L	L	L	
47		L				
48			L	L		
50		L	L	L	L	FIAH
51	L					-348
52		L	L	L		
54				L		
55		L	L			
56	L			L	L	

ALL CELLS OF THE TABLE, LEAK (L) AND NO LEAK ( ) ARE PROGRAMMED THE EXCEPTION IS THE ADDED LOCK HOPPER 1 STEP 15B, ACTIVE ONLY FOR THE LEAK DETERMINATION OF EITHER VALVE 12 OR 14.

THIS SYSTEM IS DESIGNED TO DETERMINE ONLY ONE LEAK AT A TIME.

VALVES MUST BE PROPERLY ADJUSTED TO PREVENT LOW PRESSURE LEAKS

VALVE INTERLOCK SYSTEM

The Va ve Interlock System is used in Lock Hoppers No 1 and 2 for system safety, and to prevent undue loss of material The Interlock System is a completely independent logic system which prevents any unsafe or incorrect combination of valve positions It will inhibit the va ve safe and cor mands if these combinations are detected due to valve failure or an erroneous nput The interlocks required for Lock Hopper No 1 are shown in the tabulation on the attached sheet

The system consists of four printed circuit boards Three of these boards consist of optical solation modules Of these one Board accepts the valve limit switch inputs one accepts the valve command inputs and one drives the valve command outputs The input modules used translate from 24 VDC to the 5 VDC logic levels used on the Interlock Board The output modules translate the 5 VDC logic levels to 110 VAC in order to drive the valve solenoids. The nterlock board consists of solid state combinatorial TTL logic which accepts the valve command nputs and valve limit switch information and only outputs acceptable valve combinations A red LED on the board indicates when 5 VDC logic power is present

The Interlock Boards are all extensively tested before installation in the controller system The test consists of cycling the boards over an extended temperature range while exercising them to guarantee proper functionality This testing ensures that the semiconductor devices w l exhibit no fa lures in the f eld due to "infant mortality"

LOCK HOPPER NO. 1 - VALVE INTERLOCKS

Translation Table		
Valve	Identification	Fa l - Safe Position
1	BV 1	OPEN
2	BV-2	CLOSED
3	BV-3	CLOSED
4	BV-4	CLOSED
5	BV-5	CLOSED
6	BV-6	CLOSED
7	BV 7	CLOSED
8	BV-8	CLOSED
9	BV-9	CLOSED
9A	BV-9A	CLOSED
10	BV 10	CLOSED
11	BV 11	OPEN
12	BV 12	CLOSED
13	BV 13	CLOSED
14	BV 14	CLOSED
15	BV 15	OPEN
16	BV 16	CLOSED

CONDITIONS REQUIRED →

Va ve No	1	2	3	4	5	6	7	8	9	9A	10	11	12	13	14	15	16
1	■																
2		■	O		O												
3			■	C					C	C	C	O	C		C	O	C
4			C	■	C												
5				C	■				C	C	C	O	C		C	O	C
6						■	C		C	C	C	O	C		C	O	C
7						C	■	C									
8							C	■	C	C	C	O	C		C	O	C
9			C	O	C	C	O	C	■	C					C		C
9A			C	O	C	C	O	C	C	■					C		C
10			C	O	C	C	O	C		O	■	C			C		C
11											C	■	C				
12			C	O	C	C	O	C		O		C	■		C		C
13														■	O		O
14			C	O	C	C	O	C	C	C	C	O	C		■	C	
15															C	■	C
16			C	O	C	C	O	C	C	C	C	O	C			C	■

TO OPEN ↓

O — Open
C Closed

LOCK HOPPER NO. 2

The normal operation of the Lock Hopper Controller is described first Next, the Delayed Stop Sequence which is included to avoid possible damage to the ball valve seating surfaces by closing on catalyst particles is described

When the Lock Hopper No 2 controller circuit breaker is closed, AC power is applied to the level switches the 5 VDC and 24 VDC power supplies, and the programmable controller The 24 VDC power supply provides power to the lamps, valve position detectors, monitor switches programmable controller DC I/O modules and the Controller Malfunction Board. The 5 VDC power supply provides power to the Controller Malfunction, Valve Interlock, and Counter/Timer Preset Boards As long as AC power is applied, these circuits are always operating and are not under the control of the process operator If the 5 VDC or 24 VDC power supply fails, the Controller Failure Alarm Relay is de-energized and the valve power and alarm contacts open

The Controller Failure Relay will energize if the Programmable Controller operation is satisfactory, causing the valve power and alarm contacts to close and the Lock Hopper No 1 Enable signal will be present

a **STOP POSITION**

Once DC power is established the start stop circuit controls further application of power to the system In the Stop position the Valve Power Relay is not energized. AC is not available to the valve solenoid output modules, and all valves are de-energized (BV-44, BV-51 open, all others closed)

Valve Status BV-44 BV 51 OPEN

"LH 2" Start Stop

The Emergency Stop Switch is in the "RUN" position the Platforming heater is operating (heater shutdown contact closed) and TAH-311 is normal (monitor switch closed), the "LH 2" pushbutton is enabled and the controller can be started or stopped by depressing the "LH-2" pushbutton Depressing the pushbutton to start the cycle turns off the red lamp in the pushbutton turns on the green lamp and energizes the Valve Power Relay and the controller proceeds into Step 0 At any time during the cycle when the pushbutton is depressed again, the Platformer Heater Shutdown or TAH-311 contact opens, the system will revert to the Stop position previously described (by the delayed stop sequence if required see description at the end of this section) The "LH 2" pushbutton is also disabled if the Platformer Heater Shutdown or TAH-311 contact opens If the Emergency Stop Switch is set to the "STOP" position or valve power is lost the system will revert immediately to the Stop position and the pushbutton is disabled

STEP 0—READY

When in Step 0 the "READY" lamp lights and BV-47 and BV 55 open BV-44 and BV 51 remain open (BV-44 opens if returning from Step 17) This position is the normal resting step between cycles of the lock hopper and except at startup, the lock hopper is full of catalyst and under a slight nitrogen pressure Step 0 follows Step 17 in normal operation

When all valve positions are confirmed and the Purge Counter Thumbwheel Switch is not set at zero the system is ready to proceed If a demand for a catalyst in the Reactor is indicated by a low level signal from L 309 (level switch open) the cycle proceeds

The level signal from the Reactor is sent to a timing circuit which is covered later in this discussion As in the case of Lock Hopper No 1, the requirement that the Purge Counter Thumbwheel Switch not be set to zero is included to prevent hazardous conditions caused by missed purges or no purges at all

A high temperature at TAH-311 (monitor switch open) indicates back flow of reactor material into the lift line Further back flow is prevented by stopping the controller which thereby closes the block and bleed valves under the lock hopper

Valve Status BV-44, BV-47 BV-51 BV 55 OPEN

STEP 1—PURGE 1

The "READY" lamp goes off and the "PURGE 1" lamp lights. The Long Cycle Timer starts timing. If the cycle operates as scheduled, the Long Cycle Timer will be reset in Step 0 of the next cycle before it times out. If any malfunction causes the cycle to stop, the Long Cycle Timer will time out and open the Long Cycle Alarm contact.

In normal operation, the lock hopper pressure is low (monitor switches PI-345-1 and PI-345-2 closed) BV-49A opens and BV-51 closes and the cycle proceeds.

However, if the lock hopper is stopped while under pressure, BV-49 opens and the lock hopper depressures to the flare system. When the pressure drops to the setpoint of PI-345-1 (monitor switch closed) BV-49 closes and BV-49A opens to the heater firebox The lock hopper continues to depressure through BV-49A and when the pressure falls to the setpoint of PI-345-2 (monitor switch closed) BV 51 closes. When the valve is closed the cycle proceeds

Valve Status. BV-44, BV-47, BV-49A, BV-55 OPEN
BV-49 cycles once if necessary, closed at end of step.

STEP 2—PURGE 1

BV 50 opens. Conditions which must be satisfied before the step proceeds are

verification satisfied, FI-344 low (monitor switch open) and
PI-345-2 (monitor switch closed)

When all these conditions are met BV-52 opens, and when FI-344 signals that the purge flow has risen (monitor switch closed), the Purge Timer starts timing. The purge and vent restriction orifices are sized to produce a rise in pressure during this period, and the PI-345 2 monitor switch opens. When the Purge Timer times out BV-52 closes The lock hopper depressures through BV-49A, and when the pressure falls to the setpoint of PI-345 2 (monitor switch closed) the sequence repeats in the same manner as in Lock Hopper No 1 The Purge Counter Thumbwheel Switch can be set to any number of purge cycles from 1 to 9 When the selected number of purges is complete, and all valve positions are confirmed correct the cycle proceeds

As is the case in Lock Hopper No 1 Step 2 the open position of BV 52 is not confirmed directly, the open position is confirmed by the flow indication of F -344 (monitor switch closed)

The condition above that FI-344 indicates a low flow is used for the operational check of the input circuit At this point in the cycle with BV 52 closed, the actual flow must be zero If the transmitter or input circuit fails with a high output indicating a flow the cycle will stop, and the Long Cycle Alarm contact will open when the Long Cycle Timer times out If the transmitter or input circuit fails with a low output, BV-52 will open, but no flow will be indicated, the Purge Timer will not start timing and again the cycle will stop and the Long Cycle Alarm contact will open The circuit is therefore checked against a failure in either direction

Valve Status BV-44 BV-47 BV-49A, BV 50 BV 55 OPEN
BV 52 open in subroutine closed at the end of step

STEP 3 PURGE 1

BV 47 BV-49A BV 50 and BV 55 close *The cycle proceeds when the valves are closed* and all valve positions are confirmed correct

Valve Status BV-44 OPEN

STEP 4 PRESSURE

BV 51 opens the "PURGE 1" lamp goes off and the "PRESSURE" lamp lights BV-48 and BV 54 open after BV 51 is open If PDI 343 indicates a high differential pressure (monitor switch open) FIAL 346 indicates a flow (monitor switch closed) for minimum 18 minutes and all valve positions are confirmed correct the cycle proceeds

As in the case of Lock Hopper No 1, the performance of the PDI-343 input is checked in Steps 4 and 5 A low signal is required before Step 5 can start and a high signal is required before Step 6 can start A failure in either direction will cause the Long Cycle Alarm contact to open after the Long Cycle Timer times out

Valve Status BV-44 BV-48 BV 51 BV 54 OPEN

STEP 5 PRESSURE

BV 46 opens When the lock hopper and lift engager pressures are essentially equal as indicated by PDI 343 (monitor switch closed) *the cycle proceeds*

The position of BV-46 is not confirmed and verification is not required in proceeding to Step 6 This reduces the possibility of stopping the cycle with BV-46 and BV 48 open and thus overpressuring the lock hopper

Valve Status BV-44 BV-46 BV-48 BV-51 BV 54 OPEN

STEP 6 PRESSURE

BV 46 and BV-48 close If PI-345-1 and PI-345-2 are high (monitor switches open) when the valves are closed and all valve positions are confirmed correct the cycle proceeds

PI 345-1 and PI 345-2 high outputs are checked in this step
The low outputs are checked in Step 1

Valve Status BV-44 BV 51 BV 54 OPEN

STEP 7 UNLOAD

BV 47 and BV 56 open the "PRESSURE" lamp goes off the "UNLOAD" amp lights and *when all valve positions are confirmed correct the cycle proceeds*

Valve Status BV-44 BV-47 BV 51 BV 54 BV 56 OPEN

STEP 8—UNLOAD

Note The operation of the Delayed Stop circuitry is described later

BV 53 opens The Unload Timer starts timing when the valve is verified open The cycle proceeds when the timer times out

Valve Status BV 44 BV-47 BV 51 BV 53 BV 54 BV 56 OPEN

STEP 9A UNLOAD

BV 53 closes The Dust Settling Timer starts when the valve is closed The cycle proceeds when the timer times out and all valve positions are confirmed correct

Valve Status BV-44 BV-47 BV-51 BV-54, BV-56 OPEN

STEP 9B—UNLOAD

BV 54 closes After 10 seconds and all valve positions are confirmed correct the cycle proceeds

Valve Status BV-44 BV-47 BV-51 BV-56 OPEN

STEP 10—UNLOAD

BV 56 closes and the Transfer Counter for Lift Engager No 2 advances one digit The Abnormal Loading Alarm, if in an alarm condition is reset (see Step 15) If the Purge Counter Thumbwheel Switch is not set at zero and all valve positions are confirmed correct the cycle proceeds

If the system is stopped after unload Step 10, but before Step 15, the Transfer Counter will not increment in the next cycle In this way the counts and the actual amount of catalyst transferred remain the same (If the system is stopped after unload Step 10 but before Step 15 and the *power is turned off, the counter will increment in the next cycle even though no catalyst is* unloaded causing an error between counts and the actual amount of catalyst transferred)

Valve Status BV-44 BV-47 and BV-51 OPEN

STEP 11—PURGE 2

BV 55 opens and then BV-49 opens *the "UNLOAD" lamp goes off and the "PURGE 2" lamp* lights The lock hopper depressures to the flare system through BV-49 and when the pressure falls to the setpoint of PI-345-1 (monitor switch closed) BV-49 closes and BV-49A opens The lock hopper continues to depressure through BV-49A to the heater firebox and when the pressure falls to the setpoint of PI-345-2 (monitor switch closed) BV 51 closes The cycle proceeds when all valve positions are confirmed correct.

Valve Status BV-44, BV-47, BV-49A, BV-55 OPEN
BV-49 cycles once closed at end of step

STEP 12 PURGE 2

BV 50 opens and the purge subroutine described in Step 2 is repeated opening and closing BV 52 to effect the selected number of purges

Valve Status BV-44 BV-47 BV-49A BV-50 BV-55 OPEN
BV 52 OPEN n subroutine closed at end of step

STEP 13—PURGE 2

BV 44 BV-49A and BV 50 close If LI 347 is low (level switch closed) and all valve positions are confirmed correct the cycle proceeds

As in the case of Lock Hopper No 1 Step 11 the LI 347 output is checked The level indication should be low since the lock hopper was unloaded in Step 8 If the indication is high either the LI 347 circuit has failed or the unloading line is plugged and the hopper actually

did not unload If the L 347 circuit fails and gives a low indication, the failure will cause the Abnorma Loading Alarm contact to open in Step 15

Valve Status BV-47 BV 55 OPEN

STEP 14 LOAD

BV 51 opens and then BV-43 and BV-45 open the "PURGE 2" lamp goes off the "LOAD" lamp lights and the cycle proceeds

Valve Status BV-43 BV-45 BV-47 BV-51 BV 55 OPEN

STEP 15—LOAD

Note The operation of the Delayed Stop circuitry is described later

BV-42 opens and the Abnormal Loading Minimum Timer starts timing. The Abnormal Loading Range Timer starts timing when the Abnormal Loading Minimum Timer times out. These timers will be set in the field so that the Minimum Timer times out shortly before the normal fill time and the Range Timer times out shortly after If LI-347 indicates the hopper is full (level switch open) after the Minimum Timer times out and before the Range Timer times out the loading is normal. If the hopper fills before the Minimum Timer times out, or if the Range Timer times out before the hopper is full the flow pattern is abnormal and the Abnormal Loading Alarm contact opens. The Abnorma Loading Alarm condition is retained until Step 10 of the next cycle

Normally the end of the step is signaled by LI-347 (level switch open) and the cycle proceeds If the Range Timer times out and a level signal has not appeared, the end of the step is signaled by the timer (A low level and Step 16A together will also give an Abnormal Loading Alarm)

The open position of BV-42 is not confirmed and verification is not required in proceeding to Step 16A This reduces the possibility of stopping the cycle with BV-42 open and subsequently closing BV-43 and BV-45 on catalyst particles.

Valve Status BV-42 BV-43 BV-45, BV-47 BV-51, BV-55 OPEN

STEP 16A LOAD

BV-42 closes The Dust Settling Timer starts timing when the valve is closed. The cycle proceeds when the timer times out *and all valve positions are confirmed correct* If LI-347 indicates a low level (level switch closed) the Abnormal Loading Alarm contact opens

Valve Status BV-43 BV-45 BV-47 BV 51 BV-55 OPEN

STEP 16B LOAD

BV-43 closes After a 10 second delay and all valve positions are confirmed correct the cycle proceeds

Valve Status BV-45 BV-47 BV 51 BV 55 OPEN

STEP 17—LOAD

BV-45 closes. When the valve is closed and all valve positions are confirmed correct the cycle is complete

Valve Status BV-47 BV 51 BV 55 OPEN

When the cycle is complete, the Long Cycle Timer is reset, the system returns to Step 0 wherein BV-44 opens.

b DELAYED STOP SEQUENCE

When the operator pushes the "LH-2" pushbutton to stop the system, the red lamp in the pushbutton lights immediately to acknowledge the operator's action However if the system goes into the Delayed Stop sequence the green lamp remains on until the sequence is complete Likewise the Valve Power Relay remains energized during this period to supply power to the valves.

The system will return to the Stop position (previously described) if the "LH-2" pushbutton is depressed at any time in the cycle except Steps 8, 9A, 9B, 15, 16A, or 16B If the cycle is in Unload Step 8 9A, 9B, or in Load Step 15, 16A, or 16B, closing of catalyst valves BV-54 and BV-56 or BV-43 and BV-45 is delayed until the dust settling steps have been completed

If the cycle is in Step 8 when the "LH-2" pushbutton is depressed the Unload Timer is bypassed and the cycle proceeds into Step 9A in which Unload Vee-ball BV-53 closes and the Dust Settling Timer starts. The system returns to the Stop position when Step 9B is completed. The cycle being in Step 8A or 9B when the "LH-2" pushbutton is depressed the system completes Step 9B, resets the Long Cycle Timer and then returns to the Stop position The system can not be restarted until it has returned to the Stop position

The delayed stop in Steps 15 16A and 16B is similar; if the "LH-2" pushbutton is depressed in Step 15, the lock hopper moves immediately into Step 16A, bypassing LI 347 and the Abnormal Loading Timer The system returns to the Stop position when Step 16B is completed. The cycle being in Step 16A or 16B when the "LH-2" pushbutton is depressed the system completes Step 16B resets the Long Cycle Timer and then returns to the Stop position The system can not be restarted until it has returned to the Stop position

If the Platforming Heater Shutdown or TAH-311 contact opens while the system is in Steps 8 9A, 9B 15 16A, or 16B the delayed stop function will operate normally If the "EMERGENCY STOP" switch is turned to the "Stop" position, all valves except BV-61 will immediately go to the de-energized position

c VER FICATION

The comments for Lock Hopper No 1 apply, except that in this case, verification is not used to inhibit advance between Steps 5 and 6 and Steps 15 and 16A.

The bleeder vent line from the Lock Hopper to the Platforming Heater firebox is purged with nitrogen to insure that the gases venting from BV-44, which could contain air do not mix with the hydrogen rich gases from the other bleeder vents. If the purge flow indicated by F AL 394 drops (monitor switch open) verification will not be confirmed and the cycle will halt until purge flow is restored.

d VALVE LEAK DETERMINATION AID

The comments in the description of Lock Hopper No 1 apply

4 5 9 4 0 04 10 07

e **CONTROLLER MALFUNCTION BOARD**

The comments in the description of Lock Hopper No 1 apply

f **REACTOR LEVEL CIRCUIT**

When L 309 indicates a low level (level switch open) the LH 1 cycle counter is reset and the Reactor Level Timer starts timing The timer is reset when LI-309 indicates a high level (level switch closed) The LAHL 309 alarm contact will open if the Reactor Level Timer times out (40 minutes) before the LI-309 level switch closes Also the LH-1 Step 1 enable signal to the Master Controller will turn off which turns off the LH-1 Step 1 Enable to Lock Hopper No 1

When L 309 indicates a high level (level switch closed) the LH-1 cycle counter counts the number of times LH 1 is in Step 7 as indicated by the LH-1 Step 7 signal to the Lock Hopper No 2 Controller If the counter counts 4 cycles then the LAHL-309 alarm contact will open Lock Hopper No 1 will continue to transfer catalyst for 2 more cycles If the counter reaches 6 cycles then the LH 1 Select Enable signal to the Master Controller is turned off, which turns off the LH 1 Step 1 Enable and disables the LH 1 Run-Hold pushbutton Lock Hopper No 1 will stop transferring catalyst

g **VALVE INTERLOCK SYSTEM**

The comments in the description of Lock Hopper No 1 apply The interlocks required are shown in the tabulation on the attached sheet

LOCK HOPPER NO. 2 - VALVE INTERLOCKS

Translation Table		
Valve	Identification	Fail Safe Position
42	BV-42	CLOSED
43	BV-43	CLOSED
44	BV-44	OPEN
45	BV-45	CLOSED
46	BV-46	CLOSED
47	BV-47	CLOSED
48	BV-48	CLOSED
49	BV-49	CLOSED
49A	BV-49A	CLOSED
50	BV-50	CLOSED
51	BV-51	OPEN
52	BV-52	CLOSED
53	BV-53	CLOSED
54	BV-54	CLOSED
55	BV-55	CLOSED
56	BV-56	CLOSED

CONDITIONS REQUIRED →

TO OPEN ↓

Valve No	42	43	44	45	46	47	48	49	49A	50	51	52	53	54	55	56
42	■	O		O												
43		■	C		C	O	C	C	C	C	O	C		C	O	C
44		C	■	C												
45			C	■	C	O	C	C	C	C	O	C		C	O	C
46		C	O	C	■	C		C	C	C	O	C				
47					C	■	C									
48		C	O	C		C	■	C	C	C	O	C				
49		C		C	C	O	C	■	C					C	O	C
49A		C		C	C	O	C	C	■					C	O	C
50		C		C	C	O	C		O	■	C			C	O	C
51										C	■	C				
52		C		C	C	O	C		O		C	■		C	O	C
53													■	O		O
54		C	O	C				C	C	C	O	C		■	C	
55														C	■	C
56		C	O	C				C	C	C	O	C			C	■

O Open
C Closed

3 MASTER CONTROLLER

When the Master Controller main circuit breaker is closed, AC power is applied to the level switches, the 5 VDC and 24 VDC power supplies, the programmable controller and the digital timer The 24 VDC power supply provides power to the lamps valve position detectors monitor switches programmable controller DC I/O modules and the Controller Malfunction Board. The 5 VDC power supply provides power to the Controller Malfunction and Counter/Timer Preset Boards. As long as AC power is applied, these circuits are always operating and are not under the control of the process operator The Controller Malfunction Board will energize the Controller Failure Relay if the Programmable Controller operation is satisfactory causing the valve power and alarm contacts to close and Lock Hopper No 1 Enable signal will be present.

a EMERGENCY STOP SYSTEM

With DC power established the Emergency Stop System controls further application of power to the system The Emergency Stop System provides for immediate shutdown of all operations from a control board mounted two position switch When the switch is turned to the "EMERGENCY STOP" position AC power is removed from the valve solenoid AC output modules of each controller and all valves close immediately, except those which close when energized and each controller reverts to the Stop position While the Emergency Stop Switch is in the "EMERGENCY STOP" position the Lock Hopper start-stop pushbuttons are disabled also the "REGEN RUN-STOP" and all subsystem pushbuttons are disabled

When the Emergency Stop Switch is turned to the "RUN" position, AC power is reapplied to the valve solenoid AC output modules The start-stop pushbuttons in the lock hopper controllers are enabled and each lock hopper controller can be restarted by the operator In the Master Controller if all Regenerator interlocks are satisfied, the "REGEN RUN-STOP" pushbutton is enabled

It is also necessary that a signal be present from the heater shutdown system in the Platformer section If the heater shuts down the lock hoppers will be stopped. This prevents venting hydrogen into the firebox when the burners are not operating.

b REGENERATOR RUN-STOP CIRCUIT

The Regenerator Run-Stop circuit shuts down simultaneously all subsystems in the Master Controller (except the Lock Hopper Selector System) when

the Emergency Stop Switch is turned to the "EMERGENCY STOP" position

any Regenerator interlocks listed below indicates abnormal operation (contact oper) or

the "REGEN RUN STOP" pushbutton is depressed

In each case the Valve Power Relay is de-energized AC power is removed from the valve solenoid AC output modules and all valves are de-energized (BV-71 open all others closed) At the same time a Reset signal resets the Chemical Selector System, Heater Shutdown System and Catalyst Flow Control stopping operation of the subsystems and disabling all pushbuttons

When the Emergency Stop Switch is in the "RUN" position and all interlock contacts are closed the "REGEN RUN STOP" pushbutton applies AC power to the valve solenoid AC output modules and enables all subsystem pushbuttons A green lamp in the pushbutton indicates the Run position a red lamp indicates the Stop position

Regenerator interlocks are as follows

* FIAL 341	Surge Hopper Purge
* PDRCAL 354	Disengaging Hopper Regeneration Tower
* ARAHL 355	Surge Hopper Gas Hydrogen, Hydrocarbon present
* FRAL-363	Chlorination Gas
TAH-365	Chlorination Zone Outlet
* TAH-371	Regeneration Zone Outlet
* FRCAL 380	Lower Combustion Air/N_2 Purge
* FRAL 382	Regeneration Gas
* FAL 384	Oxygen Analyzer Sample Rate
* XAL-385	Regeneration Cooler Blower Shutdown

* Regenerator interlock by-pass switches located in rear of Graphic Display Panel are to be used for start-up only Any other use refer to "General Manual of Operation UOP Platforming Catalyst Section Single Transfer System" and/or contact UOP Technical Services Department

c CHEMICAL SELECTOR SYSTEM

BV 72 controls the process air to the Regenerator With the Regenerator Run Stop circuit in the "RUN" position, when the "AIR" pushbutton is depressed the lamp lights in the pushbutton and a command to open is sent to the valve AC power is applied through the programmable controller AC output module to the solenoid valve and BV 72 opens When the pushbutton is depressed again or the Reset signal is received from the Regenerator Run Stop circuit the lamp in the pushbutton goes out and BV 72 closes

BV 71 controls the nitrogen to the Regenerator The valve opens when the solenoid valve is de-energized and provides an automatic nitrogen purge on shutdown of the Regenerator or on power failure With the Regenerator Run-Stop circuit in the "RUN" position when the "N_2" pushbutton is depressed, the lamp in the pushbutton goes off and a command to close is sent to the valve AC power is supplied through the programmable controller AC output module to the solenoid and BV 71 closes When the pushbutton is depressed again or the Reset signal is received from the Regenerator Run-Stop circuit the lamp in the pushbutton lights and BV 71 opens

BV 73 controls the chloride to the Regenerator Chloride injection is permitted only if the Reset signal from the Regenerator Run-Stop circuit is not present and if the following conditions are satisfied

1 The temperature at TSL 365 is high (monitor switch closed)

2 BV 71 is closed and verified

If the temperature is not high, or if BV 71 is not closed thus admitting nitrogen into the system it is possible that combustion of the organic chloride will not occur and undesirable concentrations of the organic chloride may accumulate in the system

If all interlock conditions are satisfied when the "CHLORIDE" pushbutton is depressed the lamp lights in the pushbutton and BV 73 opens The injection of nitrogen purge can start flowing when the valve is open When FI 397 confirms that the flow is satisfactory (monitor switch closed) and BV 73 is confirmed open the Chloride Pump Relay is energized and the chloride pump starts

Loss of chloride flow during normal operation is indicated by an alarm "FRAL 362" The alarm circuitry is designed to avoid sounding the alarm unnecessarily when the chloride pump is not running

When the pushbutton is depressed again the lamp in the pushbutton goes off and BV 73 closes When BV 73 starts to close and the signal from the open position sensor disappears

the Chloride Pump Re ay s de-energized and the chloride pump stops The chloride pump stops mmed ately if the F 397 monitor switch signal *disappears or if the Reset signal is* received from the Regenerator Run-Stop circuit

The njection ne purge nitrogen flows through BV 73 to the Regenerator Loss of the njection ne purge flow when BV 73 is open is not expected, and is an alarm condition if it occurs Loss of the injection line purge flow when BV 73 is closed is expected and is the e'v e not an alarm condition The alarm circuitry is designed to take this into account

When power is applied to the controller, or when the "CHLORIDE" pushbutton is depressed to close BV 73 and stop the pump the "FIAL 397" alarm signal s bypassed When the "CHLOR DE" pushbutton is depressed to open BV-73, if the purge flow appears at FI-397 (monitor switch closed) *within 15 seconds the alarm will not sound*

f the purge flow is lost at F 397 (monitor switch open) any time after 15 seconds, the "FIAL 397" alarm indication will appear and BV 73 will close *The chloride pump stops immediately* when the purge flow is lost

n a cases the Reset signa from the Regenerator Run-Stop circuit overrides *and disables the* pushbuttons

d HEATER SHUTDOWN SYSTEM

The three electric heaters are controlled by board mounted process controllers connected to SCR power controllers The signal from the process controller to the *power controller passes* through re ay contacts in the Master Controller

Durmg norma operation of the heater the signal passes directly to the power controller If a heater interlock contact opens or the Reset signal is received from the Regenerator Run-Stop *circuit the control relay is de-energized* causing the heater to shut down

When the interlock conditions are normal and the contacts are closed, the Regenerator Run-Stop *circuit is in the Run position the heater* can be started by depressing the "HTR RESET" pushbutton The contro relay s then energized and enables the power controller A green amp n the pushbutton indicates the control circuit is active a red lamp ndicates the heater is shut down

Th s c rcu t d ffers from a others once started by the "Heater Reset" pushbutton It can be turned off only by the Reset signal or interlocks (monitor *switch open) The process operator* can reduce the process controller output to zero if required

The heater interlock contact *in the heater circuit provides direct* protection against high temperature of the heating element Protection against loss of flow through the heater is provided ndirectly through the Regenerator Run-Stop Circuit (See Regenerator Run-Stop n e locks)

The fo low ng d rect nterlocks are used

TXAH 364	Ch onnation Heater Element
TXAH 374	Regeneration Heater Element
TXAH 377	*Air Heater Element*

e CATALYST FLOW CONTROL

The Catalyst Flow Contro sets the catalyst flow rate for the entire system by regulating the flow out of the Regeneration Tower As the ca alyst flows through the Regeneration Tower the evel n the *D sengag ng Hopper goes down* When the leve is low enough L 349 enables

Step 1 of the Lock Hopper No 1 and additiona catalyst is transferred to the Disengag ng *Hopper As Lock Hopper No 1 cycles the level at the top of the Reactor goes down* When the level is low enough L -309 on the Reactor enables Step 1 of Lock Hopper No 2 Catalyst is transferred to the Reactor, thus completing the circulation loop

When the Regenerator is in the Run state the catalyst flow can be started or stopped by depressing the "CATALYST FLOW" pushbutton To start catalyst flow the pushbutton s depressed, the red lamp goes off the green lamp lights, *and the Hopper Load Timer starts* timing BV 75 will open when BV 76 is verified closed. When the Load Timer times out BV 75 closes and the Hopper Unload Timer starts timing BV 76 will open when BV 75 is verified closed When the Unload Timer times out BV 76 closes, both timers reset and the cycle repeats If the pushbutton is depressed again or if the Regenerator has gone from the Run to the Stop state both valves will close the green lamp in the pushbutton will go off and the red lamp will again light

The volume of catalyst moved per cycle of the timers is fixed by the volume of the Flow Control Hopper In the line between BV 75 and BV 76 The Load Timer is set at approximately 30 seconds holding BV 75 open long enough to insure that the hopper is filled The overall *catalyst flow rate is controlled* by varying the setting of the Unload Timer The Flow Control Hopper is sized to deliver the design catalyst flow rate in approximately 60 batches per hour

Since the timers are set to allow the Flow Control Hopper to fill completely and to empty completely, the actual flow rate of catalyst through the valves is not a factor in the accuracy and reproducibility of the overall flow rate

The Load Timer will be set in the field so that the design catalyst flow rate will be obtained when the Unload Timer is set at 30 seconds The actual catalyst flow rate can be determined by the *following formula*

$$\text{Hourly Catalyst Flow Rate} = 3600 \times \frac{\text{(Wt of one flow contro hopper load)}}{\text{(Load time + Un oad time (seconds))}}$$

f **LOCK HOPPER SELECTOR SYSTEM**

The Lock Hopper Se ector System permits Lock Hopper No 1 to operate continuously or be held n Step 0 The green lamp in the "LH-1 RUN-HOLD" pushbutton indicates the "Run" position the red lamp indicates the "Hold" position

If the Lock Hopper No 1 Select Enable signal is present when the "LH 1 RUN-HOLD" pushbutton is depressed the green lamp lights If the LH-1 enable signal from Lock Hopper No 2 is present, when LI 349 indicates a low level in the disengaging hopper then Lock Hopper No 1 Step 1 enable signal is sent to Lock Hopper No 1 When the pushbutton is depressed again or the Lock Hopper No 1 Select Enable Signal disappears, the red lamp lights and Lock Hopper No 1 will hold in Step 0 If Lock Hopper No 1 is in operation when the pushbutton is depressed it will complete its cycle and hold in Step 0

g **LAMP TEST**

When the "LAMP TEST" pushbutton is depressed the Master Controller will allow testing of Lock Hopper No 1 and No 2 Controller lamps with one pushbutton. (An additional contact on the pushbutton is provided for testing all alarm system lamps)

h **VERIFICATION**

The comments for Lock Hopper No 1 apply except that in the Master Controller the valve verification circuit is used for the Verification Alarm function and inhibiting the "CHLORIDE" pushbutton if BV 71 is not confirmed closed An additional interlock exists between the two Flow Control Hopper valves BV 75 and BV 76

I **CONTROLLER MALFUNCTION BOARD**

The comments in the description of Lock Hopper No 1 apply

j **LIFT GAS INTERLOCK**

Before Lock Hopper No 1 receives a Step 5 Enable signal allowing it to unload catalyst into the ift engager, lift gas flow meter FRAL-306 must indicate a high flow (monitor switch closed) The monitor switch will be set in the field to a value between the flow rate obtained when the lift ne s ift ng catalyst and that obtained when it is free of catalyst The interlock delays the ransfer of another load of catalyst until the previous load has cleared the lift line and prevents overfilling of the ift engager and possible valve seat damage

Monirex CCR Lock Hopper Control System Timer Settings

Internal Fixed Timers

Controller	Setting (sec.)
Master	
Verification	15
FIAL-397 Alarm Delay	15
Lock Hopper No 1	
N2 Purge	35
Cat. Collector Purge(FIAL-302)	900
Verification	15
Dust Settling 2	10
Lock Hopper No 2	
N2 Purge	35
Reactor Level	2400
Verification	15
Dust Settling 2	10
Lift Gas Flow (FIAL-346)	1080

Internal Adjustable Timers

Controller	Default Values (sec.) *
Master	
Hopper Load	30 0
Lock Hopper No 1, 2	
Long Cycle	1500
Unload	60
Abnormal Loading Min	60
Abnormal Loading Range	90
Dust Settling	10
FIAH-308	30
FIAH-318	30
FIAH-342	30
FIAH-348	30

* See Table in Troubleshooting Section for acceptable range of adjustable timer settings

A. GENERAL INSTRUCTIONS

CCR CONTROLLER TROUBLESHOOTING GUIDE

The UOP Monrex CCR Lock Hopper control system has many features which make it straight-forward to troubleshoot These features include the fo lowing

LED indicators for each input and output used in the programmable controller

Cont nuous self diagnostics and LED status indicators on the programmable controller

LED indicators for each input and output used in the valve interlock system

Blown fuse ndicators on a programmable controller outputs

Blown fuse ndicators on a fuses supplying power to the field

LED sta us ndicators on the controller malfunct on board

Annunc ator contacts for various alarms

The use of these d agnostic aids and the methodology for troubleshooting the control system will be presented n the next section Before trying to troubleshoot the system the personnel involved should have read the Operation Description Section I in this manual and be familiar with norma plant oper at on

4 3 9 9 4 4 0 4 - 1 0 - 0 7

B. TROUBLESHOOTING

Problems with the contro system wil usua y result n an ala m To troubleshoot the system n the event of an alarm read the sect on of the troubleshoot ng guide perta ning to the particu ar a arm(s) to f nd probable causes Several alarms may occur in response to certain conditions so be sure to read the sections on a alarms that have occurred to see if a common element is present

The fo low ng sections describe the various a arms which originate n the lock hopper contro er system These a arms often occur in multiples For example if one of the 24 VDC power supplies blows a fuse all alarms for that particular con ro ler wi sound at one time

1 TIMER RANGE ALARM

A T mer Range A arm ndicates that the programmable contro ler has detected that at least one va ue set on the T mer/Counter Preset Board is out of range Th s fo low ng tab e g ves the a lowab e ranges or all adjustable timers in the lock hopper contro system

MINIMUM AND MAXIMUM ADJUSTABLE TIMER VALUES

TIMER TYPE	MINIMUM VALUE (seconds)	MAXIMUM VALUE (seconds)	WHERE USED
Hopper Load	10 0	75 0	Master
Long Cyc e	1200	2100	LH#1, LH#2
Unload	60	480	LH#1, LH#2
Dust Sett ng	10	90	LH#1, LH#2
Abnorma Load ng M n mum	45	375	LH#1, LH#2
Abnorma Load ng Range	15	120	LH#1, LH#2
Bleeder Vent	0	30	LH#1, LH#2
n et Bleeder Vent	0	30	LH#1, LH#2

NOTE The purge count s not range checked because the u range of sett ngs on the thumbwhee sw tch s a lowed [0 to 9]

The programmable controller reads the Timer/Counter Preset Board via the Word Input Module In normal operation a 24 VDC output continuously powers the coil of the Timer Range Alarm Relay If a fault is detected then the coil power is cut, the alarm contact opens and the timer default value is used Possible causes for a Timer Range Alarm are as follows.

One of the values set on the Timer/Counter Preset Board is out of range

One of the cables connecting the Timer/Counter Preset Board to the Word Input Module has come loose

The Word Input Module has Failed. Check to see that the red LED diagnostic indicator on the module is lighted If not then replace the module

The Timer Range Alarm programmable controller DC output module has blown a fuse Check the LED blown fuse indicator and replace the fuse if necessary

The 5 VDC power supply has blown a fuse Check the 5 VDC power supply fuse indicator and replace the fuse if necessary

The 24 VDC power supply has blown a fuse Check the 24 VDC power supply fuse indicator and replace the fuse if necessary

2 ABNORMAL LOADING ALARM

The fill time for Lock Hopper No 1 and No 2 should be consistent during normal operation. If this loading time falls outside the field adjustable timing window, the Abnormal Loading Alarm will sound The timing window is set by adjusting the Abnormal Loading Minimum Timer to a value just short of the expected hopper filling time The Abnormal Loading Range Timer is set so that minimum load time plus load range time is greater than the expected maximum hopper filling time Both of these timing adjustments are located on the Counter/Timer Preset Boards This Alarm is only active during the "LOAD" step and will reset during the next "UNLOAD" step. The Abnormal Loading Relay coil which is driven by a 24 VDC output from the programmable controller, is normally energized In the event of an alarm the coil is de-energized and the alarm contact will open Conditions which may cause this alarm are as follows

The hopper fills faster or more slowly than expected. A blockage or bad level sensor is possible

The Abnormal Loading Minimum or Range Timer is set to the wrong value Check these values and correct if necessary

The Abnormal Loading Alarm programmable controller DC output module has blown a fuse Check the LED blown fuse indicator and replace the fuse if necessary

The 24 VDC power supply has blown a fuse Check the 24 VDC power supply fuse indicator and replace the fuse if necessary

3 VERIFICATION ALARM

Lock Hopper Controllers No 1, No 2 and the Master Controller contain a valve verification system. Each valve is continuously checked to ensure that it is in the proper position. The programmable controllers compare the valve commands being generated against the valve limit switch information If a valve is not verified in the proper position 15 seconds after the valve command has been changed then the Verification Alarm will sound. Verification is active for both the open and closed valve positions. The programmable controller will also flash the valve position lamp on the graphic display to indicate which valve has not been verified. The valve verification logic can detect the following conditions.

a. Valve is commanded open but not verified open

b Valve is commanded open and verified open but closed limit switch is stuck

c Valve is commanded closed but not verified closed

d Valve is commanded closed and verified closed but open limit switch is stuck

Possible causes for a Verification Alarm are as follows

A valve is stuck. Inspect valve and repair if necessary

A limit switch is out of adjustment Inspect limit switch and adjust if necessary

The wiring to the limit switch is broken or there may be a loose connection Inspect wiring and repair if necessary

A valve solenoid fuse has blown Check the associated neon indicator and replace the fuse if it is lighted

A limit switch fuse has blown Check pop-up fuse indicators and replace fuse if necessary

A valve interlock condition has occurred. Inspect the Valve Command Input and Valve Solenoid Output Boards in the Interlock System. If operation of the controller is normal then the pattern of the LEDs that are lighted on the Valve Command Input Board should match the pattern of the LEDs on the Valve Solenoid Output Board If the patterns do not match then there is an interlock problem. Determine which valve command is not being passed through to the Valve Solenoid Output Board. Check the Valve Interlocks Table in the process description against the LEDs on the Limit Switch Input Board to determine what is causing the lock-out of the valve command

The Verification Alarm programmable controller DC output module has blown a fuse Check the LED fuse indicator and replace the fuse if necessary

The 24 VDC power supply has blown a fuse Check the 24 VDC power supply fuse indicator and replace the fuse if necessary

4. POWER ALARM

Each controller continuously monitors the status of the 115 VAC power being applied to the Valve Solenoid Output Modules If the power is interrupted due to some abnormal condition the Power Alarm wil sound Whenever the valve power is cut the controller will return to the Stop position The Power Alarm will clear when the controller is restarted Possible causes for this alarm are as fo lows

A Controller Failure Alarm has occurred thereby removing power from the Valve Solenoid Output modules See the descript on of the Controller Failure Alarm for corrective actions

The process operator has thrown the Emergency Stop Switch to the "STOP" position cutt ng the valve power

A Hot or Neutra wire has broken or there is a loose connection Trace the wiring using the nterna Wiring Document and a volt meter to find the problem.

The Valve Power fuse has blown. Check fuse indicator and replace the fuse if necessary

The Power Alarm programmable controller DC output module has blown a fuse Check the LED blown fuse ndicator and replace the fuse if necessary

The 24 VDC power supply has blown a fuse Check the 24 VDC power supply fuse ndicator and replace the fuse if necessary

5 CONTROLLER FAILURE ALARM

The Contro er Malfunction Board continuously monitors the operation of the programmable contro er (For more nformation on the Controller Malfunction Board see the CCR Process Descr ption) f the operation of the programmable controller is found to be abnormal the Controller Fa lure A arm wi sound n addition the power to the Valve Solenoid Output modules will be cut the Lock Hopper No 1 Enab e signa s w ll be cut and in the Master Controller the Regenerator heaters w ll shut down Once the cause of the alarm has been remedied the Controller Malfunction Board can be reset by cyc ng the power to the controller cabinet Possible causes of this alarm are as follows

The programmab e contro ler has fa led Check the "PC GOOD" LED on the programmable controller If it is not lit hen replace the programmable controller

The Heartbeat Output module on the programmable controller has blown a fuse Check the Blown Fuse ndicator for the Heartbeat Output module and rep ace the fuse if necessary

The 5 VDC power supply has blown a fuse Check the 5 VDC power supply fuse indcator and replace the fuse f necessary

The 24 VDC power supply has blown a fuse Check the 24 VDC power supply fuse ndicator and rep ace the fuse f necessary

6 LONG CYCLE ALARM

The respective Long Cycle Timer is started when Lock Hopper No 1 or No 2 begins Step 1 The Long Cycle Alarm will sound if the cycle does not complete within the time set on the Timer/Counter Preset Board The procedure to follow in this case is as follows

1 Determine which step the controller is in

2 Read the process description for this step and note which inputs are required for the cycle to proceed

3 Check the red LED status indicators on the programmable controller input modules to determine which input is not in the proper state (NOTE In some cases the input must be off in order for the cycle to proceed)

4 Locate the field switch or contact in question on the Controller Internal Wiring document

5 Check the fuse indicator for the fuse which provides field power to the switch or contact (AC fuses are provided with a neon indicating fuse holder DC fuses have a pop-up indicator built into the fuse itself)

6 Using a volt meter ensure that the field power terminal is in fact providing the proper voltage (Either 24 VDC or 115 VAC)

7 Use a volt meter to ensure that the field switch or contact in question is actually in the expected state

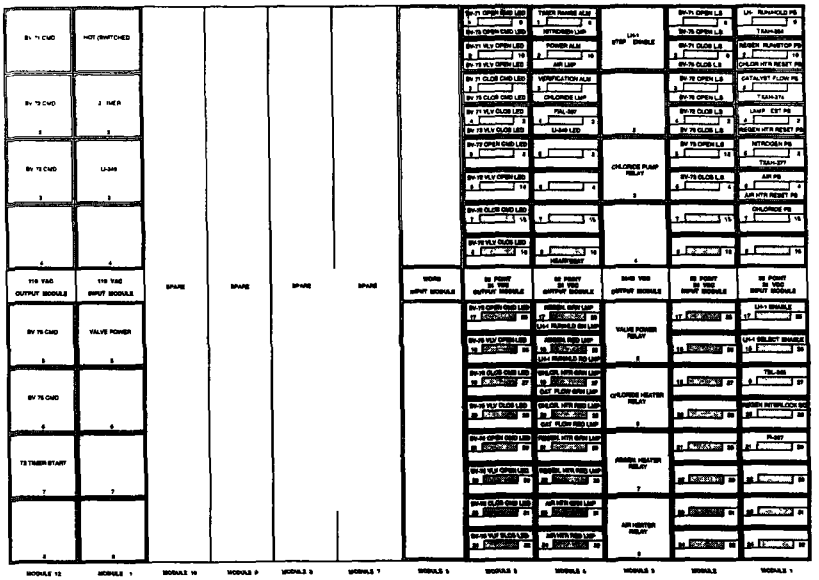
8 If the field switch or contact is in the proper state but the programmable controller nput module st ll does not acknowledge it then use a volt meter and the Interna Wiring Document to look for a broken wire or loose connection in the wiring

9 When the condition holding up the sequence is resolved the controller will complete the cycle The Long Cycle Alarm will clear when the controller returns to Step 0

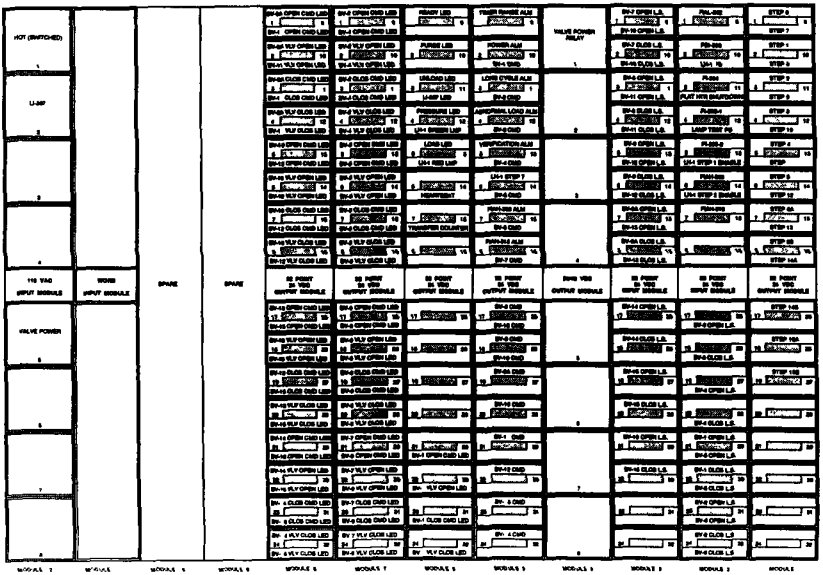
4 5 9 4 5 0 4 1 0 0 7

23 59 47 04 10 07

MASTER CONTROLLER I/O ASSIGNMENTS

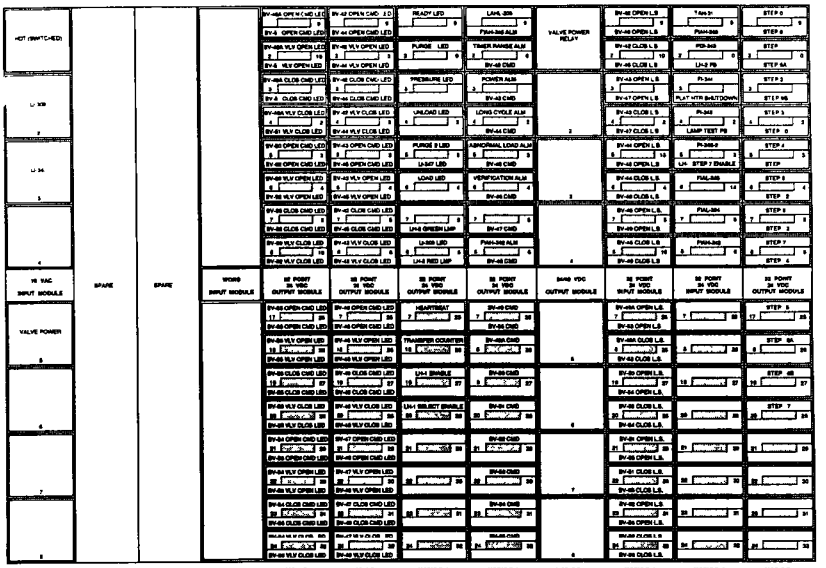


LOCK HOPPER 1 I/O ASSIGNMENTS



23 59 47 04 10 07

LOCK HOPPER 2 I/O ASSIGNMENTS



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CCR LOCK HOPPER CONTROL SYSTEM

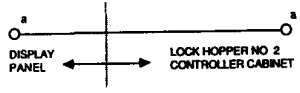
WIRING LIST

NUMBER	REVISION
8011 7076-1610	0
SHEET 1	
BY PBX APP D FHF	
DATE April 12 1990	

DISPLAY PANEL WIRING

CONDUIT #	IDENTIFICATION	DETAILS
1	MAIN POWER (115VAC, 50Hz)	UOP Specification 7589 670
2	SHUTDOWN AND ALARM SWITCHES	UOP Specification 7589 670
21	HEATER PHASE FIRING LIGHTS	UOP Specification 7589 669

DISPLAY PANEL TO LOCK HOPPER NO. 2 CONTROLLER WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINAL #	WIRE GAUGE
3	24 VDC POWER	3020	#20 AWG
3	PUSHBUTTON CONTACT LH #2	3021	#20 AWG
3	ANNUNCIATOR POWER	3050	#20 AWG
3	POWER ALARM	3051	#20 AWG
3	VERIFICATION ALARM	3052	#20 AWG
3	LONG CYCLE ALARM	3053	#20 AWG
3	ABNORMAL LOADING ALARM	3054	#20 AWG
3	LAHL-309 ALARM	3055	#20 AWG
3	**CONTROLLER FAILURE ALARM**	**3056**	**#20 AWG***
3	**TIMER RANGE ALARM**	**3057**	**#20 AWG***
3	**FIAH-342 ALARM**	**3058**	**#20 AWG****
3	**FIAH-348 ALARM**	**3059**	**#20 AWG****
3	DISPLAY COMMON	3100	#14 AWG
3	LH #2 PUSHBUTTON GREEN LAMP	3101	#20 AWG
3	LH #2 PUSHBUTTON RED LAMP	3102	#20 AWG
3	BV-42 DISPLAY LAMP CMD CLOSED	3103	#20 AWG
3	BV-42 DISPLAY LAMP POS CLOSED	3104	#20 AWG
3	BV-42 DISPLAY LAMP CMD OPEN	3105	#20 AWG
3	BV-42 DISPLAY LAMP POS OPEN	3106	#20 AWG
3	BV-43 DISPLAY LAMP CMD CLOSED	3107	#20 AWG
3	BV-43 DISPLAY LAMP POS CLOSED	3108	#20 AWG
3	BV-43 DISPLAY LAMP CMD OPEN	3109	#20 AWG
3	BV-43 DISPLAY LAMP POS OPEN	3110	#20 AWG
3	BV-44 DISPLAY LAMP CMD OPEN	3111	#20 AWG
3	BV-44 DISPLAY LAMP POS OPEN	3112	#20 AWG
3	BV-44 DISPLAY LAMP CMD CLOSED	3113	#20 AWG
3	BV-44 DISPLAY LAMP POS CLOSED	3114	#20 AWG

* See Note #3
** See Note #5

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CCR LOCK HOPPER CONTROL SYSTEM

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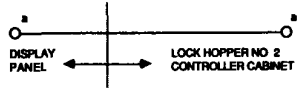
SHEET 3
BY PBX APP'D FHF
DATE April 12, 1990

DISPLAY PANEL TO LOCK HOPPER NO. 2 CONTROLLER WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINAL #	WIRE GAUGE
3 (cont'd)	BV-45 DISPLAY LAMP CMD CLOSED	3115	#20 AWG
3	BV-45 - DISPLAY LAMP POS CLOSED	3116	#20 AWG
3	BV-45 - DISPLAY LAMP CMD OPEN	3117	#20 AWG
3	BV-45 DISPLAY LAMP POS OPEN	3118	#20 AWG
3	BV-46 DISPLAY LAMP CMD CLOSED	3119	#20 AWG
3	BV-46 - DISPLAY LAMP POS CLOSED	3120	#20 AWG
3	BV-46 - DISPLAY LAMP CMD OPEN	3121	#20 AWG
3	BV-46 DISPLAY LAMP POS OPEN	3122	#20 AWG
3	BV-47 DISPLAY LAMP CMD OPEN	3123	#20 AWG
3	BV-47 DISPLAY LAMP POS OPEN	3124	#20 AWG
3	BV-47 DISPLAY LAMP CMD CLOSED	3125	#20 AWG
3	BV-47 DISPLAY LAMP POS. CLOSED	3126	#20 AWG
3	BV-48 DISPLAY LAMP CMD CLOSED	3127	#20 AWG
3	BV-48 - DISPLAY LAMP POS CLOSED	3128	#20 AWG
3	BV-48 DISPLAY LAMP CMD OPEN	3129	#20 AWG
3	BV-48 DISPLAY LAMP POS OPEN	3130	#20 AWG
3	BV-49 DISPLAY LAMP CMD CLOSED	3131	#20 AWG
3	BV-49 - DISPLAY LAMP POS CLOSED	3132	#20 AWG
3	BV-49 DISPLAY LAMP CMD OPEN	3133	#20 AWG
3	BV-49 DISPLAY LAMP POS OPEN	3134	#20 AWG
3	BV-50 DISPLAY LAMP CMD CLOSED	3135	#20 AWG
3	BV-50 DISPLAY LAMP POS CLOSED	3136	#20 AWG
3	BV-50 DISPLAY LAMP CMD OPEN	3137	#20 AWG
3	BV-50 DISPLAY LAMP POS OPEN	3138	#20 AWG

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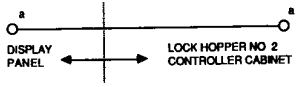
8011 7076-1610	0
SHEET 4	
BY PBX APP D FHF	
DATE Apri 12 1990	

DISPLAY PANEL TO LOCK HOPPER NO. 2 CONTROLLER WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINAL #	WIRE GAUGE
3 (cont'd)	BV-51 DISPLAY LAMP CMD OPEN	3139	#20 AWG
3	BV 51 DISPLAY LAMP POS OPEN	3140	#20 AWG
3	BV 51 DISPLAY LAMP CMD CLOSED	3141	#20 AWG
3	BV 51 D SPLAY LAMP POS CLOSED	3142	#20 AWG
3	BV-52 D SPLAY LAMP CMD CLOSED	3143	#20 AWG
3	BV 52 D SPLAY LAMP POS CLOSED	3144	#20 AWG
3	BV-52 D SPLAY LAMP CMD OPEN	3145	#20 AWG
3	BV 52 D SPLAY LAMP POS OPEN	3146	#20 AWG
3	BV 53 DISPLAY LAMP CMD CLOSED	3147	#20 AWG
3	BV 53 DISPLAY LAMP POS CLOSED	3148	#20 AWG
3	BV 53 D SPLAY LAMP CMD OPEN	3149	#20 AWG
3	BV 53 DISPLAY LAMP POS OPEN	3150	#20 AWG
3	BV-54 D SPLAY LAMP CMD CLOSED	3151	#20 AWG
3	BV 54 D SPLAY LAMP POS CLOSED	3152	#20 AWG
3	BV 54 DISPLAY LAMP CMD OPEN	3153	#20 AWG
3	BV 54 DISPLAY LAMP POS OPEN	3154	#20 AWG
3	BV-55 DISPLAY LAMP CMD OPEN	3155	#20 AWG
3	BV 55 D SPLAY LAMP POS OPEN	3156	#20 AWG
3	BV 55 D SPLAY LAMP CMD CLOSED	3157	#20 AWG
3	BV 55 D SPLAY LAMP POS CLOSED	3158	#20 AWG
3	BV 56 D SPLAY LAMP CMD CLOSED	3159	#20 AWG
3	BV 56 D SPLAY LAMP POS CLOSED	3160	#20 AWG
3	BV 56 D SPLAY LAMP CMD OPEN	3161	#20 AWG
3	BV 56 DISPLAY LAMP POS OPEN	3162	#20 AWG

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CCR LOCK HOPPER CONTROL SYSTEM

WIRING LIST

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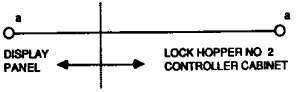
8011 7076-1610	0
SHEET 5	
BY PBX APP D FHF	
DATE Apri 12 1990	

DISPLAY PANEL TO LOCK HOPPER NO. 2 CONTROLLER WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINAL #	WIRE GAUGE
3 (cont'd)	BV-49A - DISPLAY LAMP CMD CLOSED	3163	#20 AWG
3	BV-49A DISPLAY LAMP POS CLOSED	3164	#20 AWG
3	BV-49A DISPLAY LAMP CMD OPEN	3165	#20 AWG
3	BV-49A D SPLAY LAMP POS OPEN	3166	#20 AWG
3	LI-347 DISPLAY LAMP	3183	#20 AWG
3	LI-309 DISPLAY LAMP	3184	#20 AWG
3	READY DISPLAY LAMP	3190	#20 AWG
3	PURGE 1 DISPLAY LAMP	3191	#20 AWG
3	PRESSURE DISPLAY LAMP	3192	#20 AWG
3	UNLOAD DISPLAY LAMP	3193	#20 AWG
3	PURGE 2 DISPLAY LAMP	3194	#20 AWG
3	LOAD DISPLAY LAMP	3195	#20 AWG
3	LIFT ENGAGER NO 2 TRANSFER COUNTER	3196	#20 AWG
3	SPARE	SP51	#20 AWG
3	SPARE	SP52	#20 AWG
3	SPARE	SP53	#20 AWG
3	SPARE	SP54	#20 AWG
3	SPARE	SP55	#20 AWG
3	SPARE	SP56	#20 AWG
3	SPARE	SP57	#20 AWG
3	SPARE	SP58	#20 AWG
3	SPARE	SP59	#20 AWG
3	SPARE	SP60	#20 AWG

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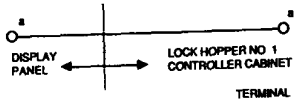
DISPLAY PANEL TO LOCK HOPPER NO. 1 CONTROLLER WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINAL a	WIRE GAUGE
4	24 VDC POWER	1020	#20 AWG
4	PUSHBUTTON CONTACT LH #1	1021	#20 AWG
4	ANNUNCIATOR POWER	1050	#20 AWG
4	POWER ALARM	1051	#20 AWG
4	VERIFICATION ALARM	1052	#20 AWG
4	LONG CYCLE ALARM	1053	#20 AWG
4	ABNORMAL LOADING ALARM	1054	#20 AWG
4	**CONTROLLER FAILURE ALARM**	**1056**	**#20 AWG***
4	**TIMER RANGE ALARM**	**1057**	**#20 AWG***
4	**FIAH-308 ALARM**	**1058**	**#20 AWG****
4	**FIAH-318 ALARM**	**1059**	**#20 AWG****
4	DISPLAY COMMON	1100	#14 AWG
4	LH #1 PUSHBUTTON - GREEN LAMP	1101	#20 AWG
4	LH #1 PUSHBUTTON RED LAMP	1102	#20 AWG
4	BV 1 DISPLAY LAMP CMD OPEN	1103	#20 AWG
4	BV 1 DISPLAY LAMP POS OPEN	1104	#20 AWG
4	BV 1 DISPLAY LAMP CMD CLOSED	1105	#20 AWG
4	BV 1 DISPLAY LAMP POS CLOSED	1106	#20 AWG
4	BV-2 DISPLAY LAMP CMD CLOSED	1107	#20 AWG
4	BV 2 DISPLAY LAMP POS CLOSED	1108	#20 AWG
4	BV 2 DISPLAY LAMP CMD OPEN	1109	#20 AWG
4	BV 2 DISPLAY LAMP POS OPEN	1110	#20 AWG
4	BV-3 DISPLAY LAMP CMD CLOSED	1111	#20 AWG
4	BV 3 DISPLAY LAMP POS CLOSED	1112	#20 AWG
4	BV-3 DISPLAY LAMP CMD OPEN	1113	#20 AWG
4	BV 3 DISPLAY LAMP POS OPEN	1114	#20 AWG
4	BV-4 DISPLAY LAMP CMD OPEN	1115	#20 AWG
4	BV-4 D SPLAY LAMP POS OPEN	1116	#20 AWG
4	BV-4 DISPLAY LAMP CMD CLOSED	1117	#20 AWG
4	BV-4 D SPLAY LAMP POS CLOSED	1118	#20 AWG

* See Note #3
** See Note #5

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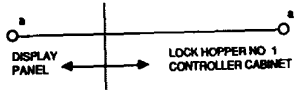
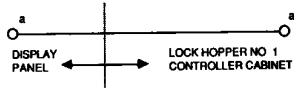
DISPLAY PANEL TO LOCK HOPPER NO. 1 CONTROLLER WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINAL a	WIRE GAUGE
4 (cont'd)	BV-5 - DISPLAY LAMP CMD CLOSED	1119	#20 AWG
4	BV-5 DISPLAY LAMP POS CLOSED	1120	#20 AWG
4	BV-5 DISPLAY LAMP CMD OPEN	1121	#20 AWG
4	BV-5 - DISPLAY LAMP POS. OPEN	1122	#20 AWG
4	BV-6 - DISPLAY LAMP CMD CLOSED	1123	#20 AWG
4	BV-6 - DISPLAY LAMP POS CLOSED	1124	#20 AWG
4	BV-6 DISPLAY LAMP CMD OPEN	1125	#20 AWG
4	BV-6 - DISPLAY LAMP POS OPEN	1126	#20 AWG
4	BV 7 DISPLAY LAMP CMD OPEN	1127	#20 AWG
4	BV 7 DISPLAY LAMP POS. OPEN	1128	#20 AWG
4	BV 7 DISPLAY LAMP CMD. CLOSED	1129	#20 AWG
4	BV 7 DISPLAY LAMP POS. CLOSED	1130	#20 AWG
4	BV-8 DISPLAY LAMP CMD CLOSED	1131	#20 AWG
4	BV-8 - DISPLAY LAMP POS CLOSED	1132	#20 AWG
4	BV-8 - DISPLAY LAMP CMD. OPEN	1133	#20 AWG
4	BV-8 - DISPLAY LAMP POS OPEN	1134	#20 AWG
4	BV-9 DISPLAY LAMP CMD CLOSED	1135	#20 AWG
4	BV-9 - DISPLAY LAMP POS CLOSED	1136	#20 AWG
4	BV-9 - DISPLAY LAMP CMD OPEN	1137	#20 AWG
4	BV-9 DISPLAY LAMP POS OPEN	1138	#20 AWG
4	BV 10 DISPLAY LAMP CMD CLOSED	1139	#20 AWG
4	BV-10 DISPLAY LAMP POS CLOSED	1140	#20 AWG
4	BV 10 DISPLAY LAMP CMD OPEN	1141	#20 AWG
4	BV 10 DISPLAY LAMP POS OPEN	1142	#20 AWG

23 SEP 91 04:10:07

DISPLAY PANEL TO LOCK HOPPER NO. 1 CONTROLLER WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINAL a	WIRE GAUGE
4 (cont'd)	BV 11 DISPLAY LAMP CMD OPEN	1143	#20 AWG
4	BV 11 DISPLAY LAMP POS OPEN	1144	#20 AWG
4	BV 11 DISPLAY LAMP CMD CLOSED	1145	#20 AWG
4	BV 11 D SPLAY LAMP POS CLOSED	1146	#20 AWG
4	BV 12 DISPLAY LAMP CMD CLOSED	1147	#20 AWG
4	BV 12 D SPLAY LAMP POS CLOSED	1148	#20 AWG
4	BV 12 DISPLAY LAMP CMD OPEN	1149	#20 AWG
4	BV 12 D SPLAY LAMP POS OPEN	1150	#20 AWG
4	BV 13 DISPLAY LAMP CMD CLOSED	1151	#20 AWG
4	BV 13 D SPLAY LAMP POS CLOSED	1152	#20 AWG
4	BV 13 DISPLAY LAMP CMD OPEN	1153	#20 AWG
4	BV 13 DISPLAY LAMP POS OPEN	1154	#20 AWG
4	BV 14 D SPLAY LAMP CMD CLOSED	1155	#20 AWG
4	BV 14 D SPLAY LAMP POS CLOSED	1156	#20 AWG
4	BV 14 DISPLAY LAMP CMD OPEN	1157	#20 AWG
4	BV 14 D SPLAY LAMP POS OPEN	1158	#20 AWG
4	BV 15 DISPLAY LAMP CMD OPEN	1159	#20 AWG
4	BV 15 D SPLAY LAMP POS OPEN	1160	#20 AWG
4	BV 15 D SPLAY LAMP CMD CLOSED	1161	#20 AWG
4	BV 15 D SPLAY LAMP POS CLOSED	1162	#20 AWG
4	BV 16 D SPLAY LAMP CMD CLOSED	1163	#20 AWG
4	BV 16 D SPLAY LAMP POS CLOSED	1164	#20 AWG
4	BV 16 D SPLAY LAMP CMD OPEN	1165	#20 AWG
4	BV 16 D SPLAY LAMP POS OPEN	1166	#20 AWG

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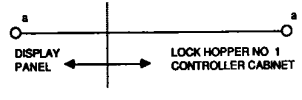
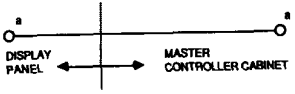
DISPLAY PANEL TO LOCK HOPPER NO. 1 CONTROLLER WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINAL a	WIRE GAUGE
4 (cont'd)	BV-9A - DISPLAY LAMP CMD CLOSED	1167	#20 AWG
4	BV-9A DISPLAY LAMP POS CLOSED	1168	#20 AWG
4	BV-9A DISPLAY LAMP CMD OPEN	1169	#20 AWG
4	BV-9A DISPLAY LAMP POS OPEN	1170	#20 AWG
4	LI-307 DISPLAY LAMP	1183	#20 AWG
4	READY DISPLAY LAMP	1190	#20 AWG
4	PURGE DISPLAY LAMP	1191	#20 AWG
4	UNLOAD DISPLAY LAMP	1192	#20 AWG
4	PRESSURE DISPLAY LAMP	1193	#20 AWG
4	LOAD DISPLAY LAMP	1194	#20 AWG
4	LIFT ENGAGER NO 1 TRANSFER COUNTER	1198	#20 AWG
4	SPARE	SP22	#20 AWG
4	SPARE	SP23	#20 AWG
4	SPARE	SP24	#20 AWG
4	SPARE	SP25	#20 AWG
4	SPARE	SP26	#20 AWG
4	SPARE	SP27	#20 AWG
4	SPARE	SP28	#20 AWG
4	SPARE	SP29	#20 AWG
4	SPARE	SP30	#20 AWG

DISPLAY PANEL TO MASTER CONTROLLER WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINAL a	WIRE GAUGE
5 (cont'd)	BV 73 - DISPLAY LAMP CMD CLOSED	121	#20 AWG
5	BV 73 DISPLAY LAMP POS CLOSED	122	#20 AWG
5	BV 73 DISPLAY LAMP CMD OPEN	123	#20 AWG
5	BV 73 DISPLAY LAMP POS OPEN	124	#20 AWG
5	BV 75 - DISPLAY LAMP CMD CLOSED	129	#20 AWG
5	BV 75 DISPLAY LAMP POS CLOSED	130	#20 AWG
5	BV 75 DISPLAY LAMP CMD OPEN	131	#20 AWG
5	BV 75 DISPLAY LAMP POS OPEN	132	#20 AWG
5	BV 76 - DISPLAY LAMP CMD CLOSED	133	#20 AWG
5	BV 76 DISPLAY LAMP POS CLOSED	134	#20 AWG
5	BV 76 DISPLAY LAMP CMD OPEN	135	#20 AWG
5	BV 76 DISPLAY LAMP POS OPEN	136	#20 AWG
5	LI-349 DISPLAY LAMP	164	#20 AWG
	PUSHBUTTON LAMPS		
5	REGENERATOR GREEN	151	#20 AWG
5	REGENERATOR RED	152	#20 AWG
5	CATALYST FLOW GREEN	153	#20 AWG
5	CATALYST FLOW RED	154	#20 AWG
5	CHLORINATION HEATER GREEN	155	#20 AWG
5	CHLORINATION HEATER RED	156	#20 AWG
5	REGENERATION HEATER GREEN	157	#20 AWG
5	REGENERATION HEATER RED	158	#20 AWG
5	AIR HEATER GREEN	159	#20 AWG
5	AIR HEATER RED	160	#20 AWG
5	LH #1 RUN-HOLD GREEN	161	#20 AWG
5	LH #1 RUN-HOLD RED	162	#20 AWG
5	NITROGEN	170	#20 AWG
5	AIR	171	#20 AWG
5	CHLORIDE	172	#20 AWG
5	SPARE	SP3	#20 AWG
5	SPARE	SP4	#20 AWG
5	SPARE	SP5	#20 AWG
5	SPARE	SP6	#20 AWG
5	SPARE	SP7	#20 AWG
5	SPARE	SP8	#20 AWG

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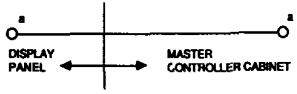
DISPLAY PANEL TO MASTER CONTROLLER WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINAL a	WIRE GAUGE
5	24 VDC POWER	20	#20 AWG
5	LAMP TEST PUSHBUTTON	21	#20 AWG
5	REGENERATOR RUN-STOP PUSHBUTTON	22	#20 AWG
5	REGENERATOR INTERLOCK	24	#20 AWG
5	CHLORINATION HEATER PUSHBUTTON	25	#20 AWG
5	REGENERATION HEATER PUSHBUTTON	28	#20 AWG
5	AIR HEATER PUSHBUTTON	31	#20 AWG
5	NITROGEN PUSHBUTTON	35	#20 AWG
5	AIR PUSHBUTTON	37	#20 AWG
5	CHLORIDE PUSHBUTTON	39	#20 AWG
5	CATALYST FLOW PUSHBUTTON	41	#20 AWG
5	LH #1 RUN-HOLD PUSHBUTTON	43	#20 AWG
5	ANNUNCIATOR POWER	50	#20 AWG
5	POWER ALARM	51	#20 AWG
5	VERIFICATION ALARM	52	#20 AWG
5	FIAL-397 ALARM	53	#20 AWG
5	FRAL-362 ALARM	54	#20 AWG
5	**CONTROLLER FAILURE ALARM**	**56**	**#20 AWG***
5	**TIMER RANGE ALARM**	**57**	**#20 AWG***
5	DISPLAY COMMON	100	#14 AWG
5	BV 71 DISPLAY LAMP CMD CLOSED	113	#20 AWG
5	BV 71 DISPLAY LAMP POS CLOSED	114	#20 AWG
5	BV 71 DISPLAY LAMP CMD OPEN	115	#20 AWG
5	BV 71 - DISPLAY LAMP POS OPEN	116	#20 AWG
5	BV 72 DISPLAY LAMP CMD CLOSED	117	#20 AWG
5	BV 72 - DISPLAY LAMP POS CLOSED	118	#20 AWG
5	BV 72 DISPLAY LAMP CMD OPEN	119	#20 AWG
5	BV 72 DISPLAY LAMP POS OPEN	120	#20 AWG

* See Note #3

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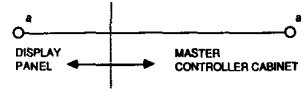
DISPLAY PANEL TO MASTER CONTROLLER WIRING (115 VAC)



CONDUIT #	IDENTIFICATION	TERM NAL a	WIRE GAUGE
6	HOT	1	#14 AWG
6	NEUTRAL	2	#14 AWG
6	HOT (SWITCHED)	3	#14 AWG
6	NEUTRAL (SWITCHED)	4	#14 AWG
6	TIMER ENABLE	6	#16 AWG
6	TIMER CONTACT	7	#16 AWG
6	TIMER CONTACT	8	#16 AWG
6	SPARE	SP15	#14 AWG
6	SPARE	SP16	#14 AWG

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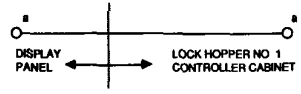
UOP
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U S.A. 60017-5017
CCR LOCK HOPPER CONTROL SYSTEM
WIRING LIST
NUMBER 8011 7076 1610 REVISION 0
SHEET 13
BY PBX APP D FHF
DATE Apri 12 1990

DISPLAY PANEL TO LOCK HOPPER NO. 1 CONTROLLER WIRING (115 VAC)



CONDUIT #	IDENTIFICATION	TERMINAL a	WIRE GAUGE
7	HOT	1001	#14 AWG
7	NEUTRAL	1002	#14 AWG
7	HOT (SWITCHED)	1003	#14 AWG
7	NEUTRAL (SWITCHED)	1004	#14 AWG
7	SPARE	SP41	#14 AWG
7	SPARE	SP42	#14 AWG

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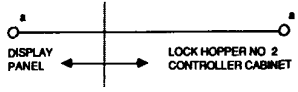
DISPLAY PANEL TO LOCK HOPPER NO. 2 CONTROLLER WIRING (115 VAC)



CONDUIT #	IDENTIFICATION	TERMINAL a	WIRE GAUGE
8	HOT	3001	#14 AWG
8	NEUTRAL	3002	#14 AWG
8	HOT (SWITCHED)	3003	#14 AWG
8	NEUTRAL (SWITCHED)	3004	#14 AWG
8	SPARE	SP70	#14 AWG
8	SPARE	SP71	#14 AWG

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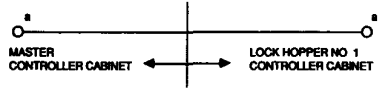
MASTER CONTROLLER TO LOCK HOPPER NO. 1 CONTROLLER WIRING (DC)



CONDUIT #	TERMINAL a	WIRE GAUGE
9	A	#16 AWG
9	B	#16 AWG
9	C	#14 AWG
9	D	#16 AWG
9	E	#16 AWG
9	F	#16 AWG
9	SP13	#16 AWG*

* SPARE

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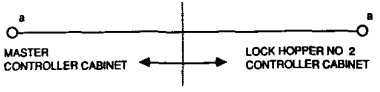
MASTER CONTROLLER TO LOCK HOPPER NO 2 CONTROLLER WIRING (DC)



CONDUIT #	TERM NAL a	WIRE GAUGE
10	W	#16 AWG
10	X	#16 AWG
10	Y	#14 AWG
10	Z	#16 AWG
10	AA	#16 AWG
10	CC	#16 AWG
10	SP14	#16 AWG*

* SPARE

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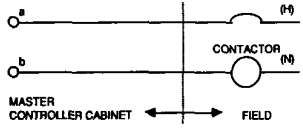
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROL SYSTEM

WIRING LIST

NUMBER 8011 7076 1610 REVISION 0
SHEET 17
BY PBX APP D FHF
DATE April 12 1990

MASTER CONTROLLER CHLORIDE PUMP CONTACTOR WIRING (115 VAC)



CONDUIT #	IDENTIFICATION	TERMINALS a	TERMINALS b	WIRE GAUGE
11	PUMP #1	314	316	#14 AWG

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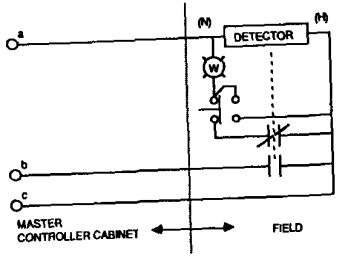
MASTER CONTROLLER LEVEL SWITCH WIRING (115 VAC)



CONDUIT #	IDENTIFICATION	TERMINALS a	b	c	WIRE GAUGE
11(cont'd)	L 349	212	211	210	#16 AWG

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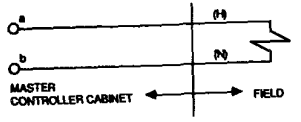
MASTER CONTROLLER SOLENOID VALVE WIRING (115 VAC)



CONDUIT #	IDENTIFICATION	TERMINALS a	b	WIRE GAUGE
11 (cont'd)	BV 71	305	306	#16 AWG
11	BV-72	308	309	#16 AWG
11	BV 73	311	312	#16 AWG
11	BV 75	317	318	#16 AWG
11	BV-76	320	321	#16 AWG
11	SPARE	SP17		#16 AWG
11	SPARE	SP18		#16 AWG

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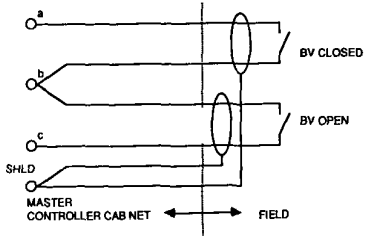
MASTER CONTROLLER VALVE LIMIT SWITCH WIRING (DC)



CONDUIT #	IDENTIFICATION	TERM NALS a	b	c	CONTACT	WIRE GAUGE
12	BV 71	221	220	222	N O	#16 AWG*
12	BV 72	224	223	225	N O	#16 AWG*
12	BV 73	227	226	228	N O	#16 AWG*
12	BV 75	233	232	234	N O	#16 AWG*
12	BV 76	236	235	237	N O	#16 AWG*
12	SPARE	SP9	SP10			#16 AWG*
12	SPARE	SP11	SP12			#16 AWG*

See Note #6

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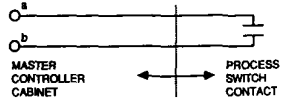
MASTER CONTROLLER PROCESS VARIABLE LOGIC SWITCH WIRING (DC



CONDUIT #	IDENTIFICATION	TERM NALS a	b	CONTACT	WIRE GAUGE
13	PLATFORMER S D	20*	23	N O	#20 AWG
13	TXAH-364	20*	27	N O	#20 AWG
13	TXAH-374	20*	30	N O	#20 AWG
13	TXAH-377	20*	33	N O	#20 AWG
13	FRAL-306	20*	47	N O	#20 AWG
13	FI 397	20*	48	N O	#20 AWG
13	TSL-365	20*	49	N O	#20 AWG
13	FRAL 362	50	54	N O	#20 AWG
13	SPARE	SP1			#20 AWG

* Terminal 20 is process switch power One terminal 20 is located in controller Customer to install one #20 AWG power wire All process switch terminal 20 power connections shall be jumpered at the process switch location (by customer)

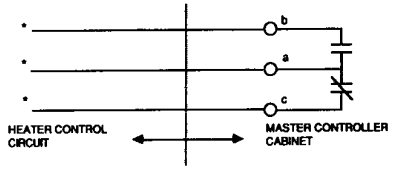
UOP
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROL SYSTEM

WIRING LIST

NUMBER 8011 - 7076 1610 - REVISION 0
SHEET 22
BY PBX APP'D FHF
DATE April 12, 1990

MASTER CONTROLLER HEATER CONTROL WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINALS a	b	c	WIRE GAUGE
13 (cont'd)	TRC-367	61	62	63	#16 AWG
13	TRC-373	64	65	66	#16 AWG
13	TRC 376	67	68	69	#16 AWG
13	SPARE	SP2			#16 AWG

* For wiring details see Project Specification 7589 669

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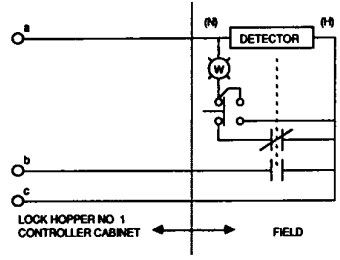
UOP
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROL SYSTEM

WIRING LIST

NUMBER 8011 7076-1610 REVISION 0
SHEET 23
BY PBX APP'D FHF
DATE April 12, 1990

LOCK HOPPER NO. 1 CONTROLLER LEVEL SWITCH WIRING (115 VAC)



CONDUIT #	IDENTIFICATION	TERMINALS a	b	c	WIRE GAUGE
14	LI-307	1212	1211	1210	#16 AWG

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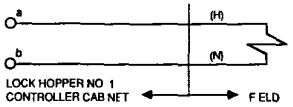
LOCK HOPPER NO. 1 CONTROLLER SOLENOID VALVE WIRING (115 VAC)



CONDUIT #	IDENTIFICATION	TERMINALS a	TERMINALS b	WIRE GAUGE
14 (cont d)	BV 1	1305	1306	#16 AWG
14	BV 2	1308	1309	#16 AWG
14	BV 3	1311	1312	#16 AWG
14	BV 4	1314	1315	#16 AWG
14	BV 5	1317	1318	#16 AWG
14	BV 6	1320	1321	#16 AWG
14	BV 7	1323	1324	#16 AWG
14	BV-8	1326	1327	#16 AWG
14	BV 9	1329	1330	#16 AWG
14	BV 10	1332	1333	#16 AWG
14	BV 11	1335	1336	#16 AWG
14	BV 12	1338	1339	#16 AWG
14	BV 13	1341	1342	#16 AWG
14	BV 14	1344	1345	#16 AWG
14	BV 15	1347	1348	#16 AWG
14	BV 16	1350	1351	#16 AWG
14	BV 9A	1353	1354	#16 AWG
14	SPARE	SP43		#16 AWG
14	SPARE	SP44		#16 AWG
14	SPARE	SP45		#16 AWG
14	SPARE	SP46		#16 AWG

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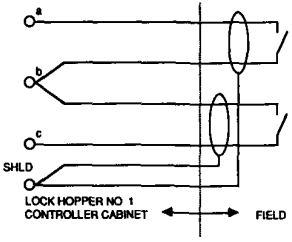
25 East Algonquin Road Des Plaines Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROL SYSTEM

WIRING LIST

NUMBER 8011 7076 1610 REVISION 0
SHEET 25
BY PBX APP D FHF
DATE April 12 1990

LOCK HOPPER NO. 1 CONTROLLER VALVE LIMIT SWITCH WIRING (DC)



CONDUIT #	IDENTIFICATION	TERM NALS a	TERM NALS b	TERM NALS c	CONTACT	WIRE GAUGE
15	BV 1	1221	1220	1222	N O	#16 AWG*
15	BV 2	1224	1223	1225	N O	#16 AWG*
15	BV 3	1227	1226	1228	N O	#16 AWG*
15	BV-4	1230	1229	1231	N O	#16 AWG*
15	BV 5	1233	1232	1234	N O	#16 AWG
15	BV-6	1236	1235	1237	N O	#16 AWG*
15	BV 7	1239	1238	1240	N O	#16 AWG*
15	BV-8	1242	1241	1243	N O	#16 AWG*
15	BV-9	1245	1244	1246	N O	#16 AWG*
15	BV 10	1248	1247	1249	N O	#16 AWG*
15	BV 11	1251	1250	1252	N O	#16 AWG*
15	BV-12	1254	1253	1255	N O	#16 AWG*
15	BV 13	1257	1256	1258	N O	#16 AWG*
15	BV 14	1260	1259	1261	N O	#16 AWG*
15	BV 15	1263	1262	1264	N O	#16 AWG*
15	BV 16	1266	1265	1267	N O	#16 AWG*
15	BV 9A	1269	1268	1270	N O	#16 AWG*
15	SPARE	SP32	SP33			#16 AWG*
15	SPARE	SP34	SP35			#16 AWG*
15	SPARE	SP36	SP37			#16 AWG*
15	SPARE	SP38	SP39			#16 AWG*

*See Note #6

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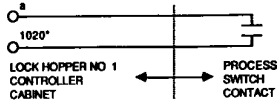
LOCK HOPPER NO. 1 CONTROLLER PROCESS VARIABLE LOGIC SWITCH WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINAL a	CONTACT	WIRE GAUGE
16	PD 303	1022	N O	#20 AWG
16	F 304	1023	N O	#20 AWG
16	PI-305 1	1024	N O	#20 AWG
16	F AL-302	1025	N O	#20 AWG
16	P 305 2	1026	N O	#20 AWG
16	**FIAH-308**	**1027**	**N.O.**	**#20 AWG****
16	**FIAH-318**	**1028**	**N.O.**	**#20 AWG****
16	SPARE	SP21		#20 AWG

* Terminal 1020 is process switch power One terminal 1020 is located in controller Customer to install one #20 AWG power wire All process switch terminal 1020 power connections shall be jumpered at the process switch location (by customer)

** See Note #4

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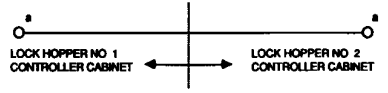
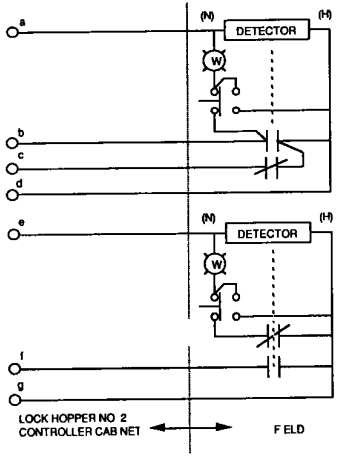
LOCK HOPPER NO. 1 CONTROLLER TO LOCK HOPPER NO. 2 CONTROLLER WIRING (DC)



CONDUIT #	TERMINAL a	WIRE GAUGE
17	H	#16 AWG

LOCK HOPPER NO. 2 CONTROLLER LEVEL SWITCH WIRING (115 VAC)



CONDUIT #	ID	TERMINALS a	b	c	d	e	f	g	WIRE GAUGE
18	L 309	3212	3210	3211	3209				#16 AWG
18	L 347					3219	3218	3217	#16 AWG

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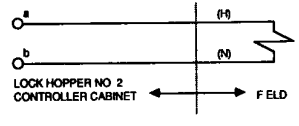
CCR LOCK HOPPER CONTROL SYSTEM

WIRING LIST

NUMBER 8011 7076 1610 REVISION 0
SHEET 29
BY PBX APP'D FHF
DATE April 12 1990

LOCK HOPPER NO. 2 CONTROLLER SOLENOID VALVE WIRING (115 VAC)



CONDUIT #	IDENTIFICATION	TERMINALS a	b	WIRE GAUGE
18 (cont'd)	BV-42	3305	3306	#16 AWG
18	BV-43	3308	3309	#16 AWG
18	BV-44	3311	3312	#16 AWG
18	BV-45	3314	3315	#16 AWG
18	BV-46	3317	3318	#16 AWG
18	BV-47	3320	3321	#16 AWG
18	BV-48	3323	3324	#16 AWG
18	BV-49	3326	3327	#16 AWG
18	BV 50	3329	3330	#16 AWG
18	BV 51	3332	3333	#16 AWG
18	BV 52	3335	3336	#16 AWG
18	BV 53	3338	3339	#16 AWG
18	BV-54	3341	3342	#16 AWG
18	BV 55	3344	3345	#16 AWG
18	BV-56	3347	3348	#16 AWG
18	BV-49A	3350	3351	#16 AWG
18	SPARE	SP72		#16 AWG
18	SPARE	SP73		#16 AWG
18	SPARE	SP74		#16 AWG
18	SPARE	SP75		#16 AWG
18	SPARE	SP76		#16 AWG

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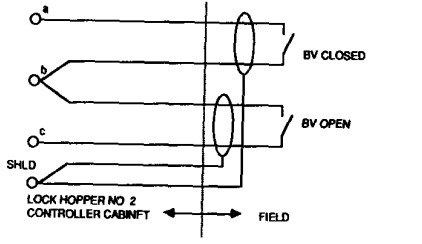
CCR LOCK HOPPER CONTROL SYSTEM

WIRING LIST

NUMBER	REVISION
8011 7076-1610	0
SHEET 30	
BY PBX APP'D FHF	
DATE April 12, 1990	

LOCK HOPPER NO. 2 CONTROLLER VALVE LIMIT SWITCH WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINALS a	b	c	CONTACT	WIRE GAUGE
19	BV-42	3221	3220	3222	N O	#16 AWG*
19	BV-43	3224	3223	3225	N O	#16 AWG
19	BV-44	3227	3226	3228	N O	#16 AWG*
19	BV-45	3230	3229	3231	N O	#16 AWG*
19	BV-46	3233	3232	3234	N O	#16 AWG*
19	BV-47	3236	3235	3237	N O	#16 AWG*
19	BV-48	3239	3238	3240	N O	#16 AWG*
19	BV-49	3242	3241	3243	N O	#16 AWG*
19	BV 50	3245	3244	3246	N O	#16 AWG*
19	BV 51	3248	3247	3249	N O	#16 AWG*
19	BV 52	3251	3250	3252	N O	#16 AWG*
19	BV 53	3254	3253	3255	N O	#16 AWG*
19	BV 54	3257	3256	3258	N O	#16 AWG*
19	BV 55	3260	3259	3261	N O	#16 AWG*
19	BV 56	3263	3262	3264	N O	#16 AWG*
19	BV 49A	3266	3265	3267	N O	#16 AWG*
19	SPARE	SP61	SP62			#16 AWG*
19	SPARE	SP63	SP64			#16 AWG*
19	SPARE	SP65	SP66			#16 AWG*
19	SPARE	SP67	SP68			#16 AWG*

*See Note #6

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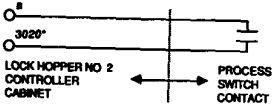
CCR LOCK HOPPER CONTROL SYSTEM

WIRING LIST

NUMBER	REVISION
8011 7076-1610	0
SHEET 31	
BY PBX APP'D FHF	
DATE April 12 1990	

LOCK HOPPER NO. 2 CONTROLLER PROCESS VARIABLE LOGIC SWITCH WIRING (DC)



CONDUIT #	IDENTIFICATION	TERMINAL #	CONTACT	WIRE GAUGE
20	PDI-343	3022	N O	#20 AWG
20	FI-344	3023	N O	#20 AWG
20	PI-345-1	3024	N O	#20 AWG
20	TAH-311	3025	N O	#20 AWG
20	FIAL-346	3026	N O	#20 AWG
20	FIAL-394	3027	N O	#20 AWG
20	PI-345-2	3028	N O	#20 AWG
20	**FIAH-342**	**3031**	**N.O.**	**#20 AWG****
20	**FIAH-348**	**3032**	**N.O.**	**#20 AWG****
20	SPARE	SP50		#20 AWG

* Terminal 3020 is process switch power One terminal 3020 is located in controller Customer to install one #20 AWG power wire All process switch terminal 3020 power connections shall be jumpered at the process switch location (by customer)

** See Note #4

00 00 02 04 11 07

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CCR LOCK HOPPER CONTROL SYSTEM

WIRING LIST

NUMBER 8011 7075-1610 REVISION 0
SHEET 32
BY PBX APP'D FHF
DATE APRIL 12 1990

CONDUIT IDENTIFICATION

NOTES
A. REFERENCE UOP ELECTRICAL STANDARD 7.11-0 GROUNDING PER UOP DRAWING 7.101-0 DETAIL 3
B MASTER LOCK HOPPER NO. 1 AND LOCK HOPPER NO. 2 CONTROLLERS MONIREX SUPPLY, MOUNTED ON BACK PLATES FOR INSTALLATION IN EXISTING CABINETS.
C DISPLAY PANEL WITH GRAPHIC DISPLAY EXISTING BY OTHERS
D CATALYST UNLOAD TIMER WITH MOUNTING PLATE MONIREX SUPPLY

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25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROL SYSTEM

WIRING LIST

NUMBER 8011 7075-1610 REVISION 0
SHEET 33
BY PBX APP'D FHF
DATE April 12 1990

NOTES

1. Electrical installation and wiring shall be in accordance with UOP electrical specification 7.11-0
2. Wire sizes shown are minimum required. Conduit/Cable to be sized by customer. Customer to confirm compliance with all applicable codes. Conduit identification shown in this document is for general signal identification/termination reference only. Cable may be used.
3. NEW SIGNAL, customer to add extra annunciator contact input and graphic display indication for this alarm.
4. Customer to remove high flow contact from annunciator and rewire to controller cabinet.
5. Customer to rewire annunciator contact to receive alarm signal from controller cabinet and set time delay to zero or use a non-delay circuit.
6. Limit Switch Wiring
   a. The connection to each switch shall consist of a twisted pair enclosed in an aluminum-polyester shield with drain wire. Wire pairs shall have a minimum of 8 twists/foot (20 twists/meter).
   b. Drain wires shall be terminated only at the terminal block provided in the Lock Hopper Controller.
   CAUTION: DO NOT connect drains to Lock Hopper Controller when using intrinsic safety barriers. Drains must be connected to ground at intrinsic safety barrier ONLY.
   c. Multi-pair cables may be used provided each pair is individually shielded. All pairs in a cable must be terminated in a single controller cabinet.
7. External Device Loads
   The electrical ratings and loads of solenoid valves and level detectors which are powered by the solid state control system shall be as follows:

Solenoid Valves	115 VAC, 20 watt, 50 VA holding, 135 VA inrush	
Level Detectors	115 VAC, 10 watt + 6 watt field lamp	

5. Wire sizes are based on the following maximum run lengths from Controller Cabinet to:

Process Field	1000 feet
Control Interface Cabinet	25 feet
Graphic Display Panel	250 feet
Power Supply from Distribution Panel to Display Panel	100 feet

C. SPARE PARTS LIST

LOCK HOPPER CONTROLLER

ITEM	RECOMMENDED QUANTITY	PART NUMBER	DESCRIPTION
1	1	13106	26 Conductor Ribbon Cable Set
2	1	13107	50 Conductor Ribbon Cable Set
3	1	11859	Programmable Controller
4	1	13116	Power Supply
5	1	11832	Output Module, 110 VAC
6	1	11828	Input Module, 110 VAC
7	1	11829	Output Module, 24/48 VDC
8	2	11839	Input Module, 32 pt LVDC
9	2	11840	Output Module, 32 pt. LVDC
10	1	11831	Word Input Module
11	1	11861	OPTO—Isolator Board
12	3	11862	Quad Pack DC Input Module
13	1	11863	Quad Pack AC Output Module
14	3	11951	Hermetically Sealed Relay
15	1	13488	Digital Timer
16	1	11893	Power Supply, 24 VDC
17	1	11887	Power Supply, 5 VDC
18	1	13553	Counter/Timer Preset Board #1
19	1	13550	Controller Malfunction Board
20	1	13108	Interlock #1 Board (Dual Vent)
21	1	13109	Interlock #2 Board (Dual Vent)
22	1	13552	Word Input/Ribbon Cable Board
23	1	13112	Counter/Timer Preset Board #2
24	10	12016	Fuse, 1/2 Amp FNM
25	30	12020	Fuse, 1 Amp FNM
26	10	12015	Fuse, 5 Amp FNM
27	30	12008	Fuse, 2/10 Amp
28	10	12009	Fuse, 1/2 Amp
29	10	12017	Picofuse, 5 Amp
30	10	12018	Picofuse, 1 Amp
31	5	12019	Fuse, 3 Amp/250 VAC Slo-Blow
32	5	11992	Fuse, 8 Amp

UOP MONIREX SYSTEMS DRAWINGS MASTER CONTROLLER

DWG. NO	TITLE
8011 7076-1612	
SHEET 1	AC Power Wiring
SHEET 2	Valve Power Wiring AC
SHEET 3	DC Power Wiring
SHEET 4	DC Return Wiring
SHEET 5	Valve Solenoid Wiring 115VAC
SHEET 6	Valve Limit Switch Wiring
SHEET 7	Valve Position Indicator Wiring
SHEET 8	Pushbutton Lamp Wiring
SHEET 9	Indicator Lamp Wiring
SHEET 10	Relay Wiring
SHEET 11	Annunciator and Interconnect Wiring
SHEET 12	Pushbutton Contact Input Wiring
SHEET 13	Switch Contact Input Contact Wiring

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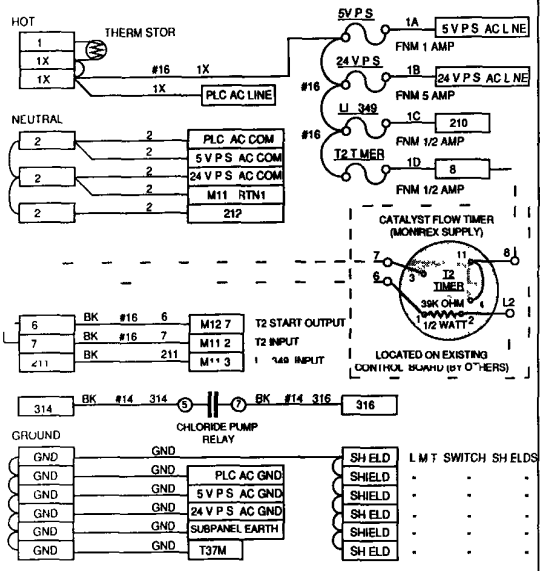
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER MASTER CONTROLLER

AC POWER WIRING

NUMBER	REVISION
8011 7076 1612	1

SHEET 1
BY PBX APP'D FHF
DATE SEPTEMBER 28 1990



NOTES
1 Wire colors
a) Hot BLACK
b) Neutral WHITE
c) Ground GREEN
2 All wires are #16 AWG unless otherwise noted
3 PLC power supply interna jumper set for 115 VAC

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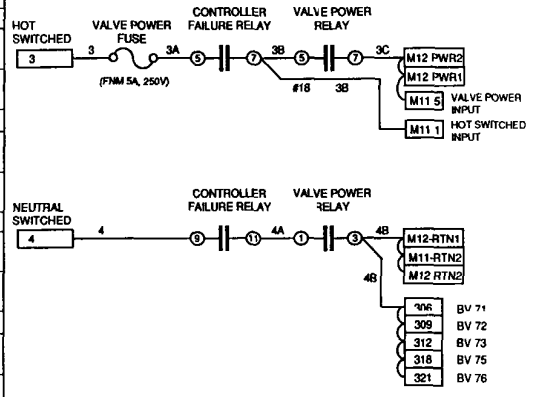
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER MASTER CONTROLLER

VALVE POWER WIRING - AC

NUMBER	REVISION
8011 7076 1612	0

SHEET 2
BY PBX APP'D
DATE SEPTEMBER 28 1990



NOTES
1 Wire colors
a) Hot BLACK
b) Neutral WHITE
2. All wires are #16 AWG unless otherwise noted

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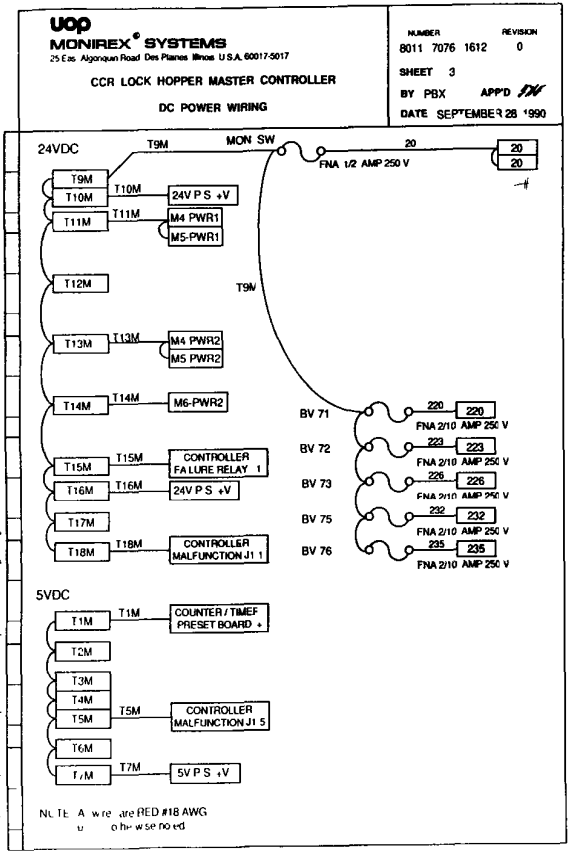

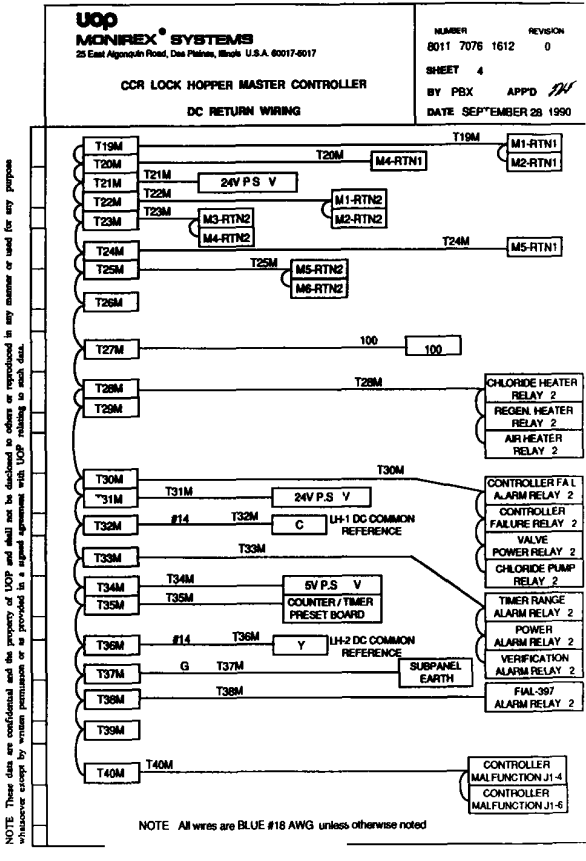

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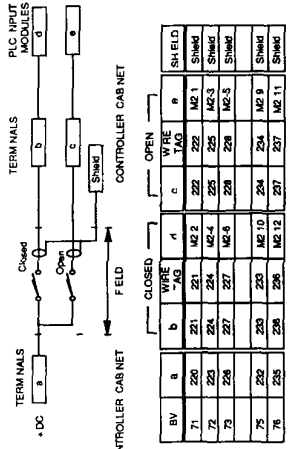
CCR LOCK HOPPER MASTER CONTROLLER

VALVE LIMIT SWITCH WIRING

NUMBER	REVISION
8011 7076 1612	0

SHEET 6
BY PBX APP'D
DATE SEPTEMBER 28 1990



	CLOSED			OPEN			SH ELD
BV	a	b	WIRE TAG	c	d	WIRE TAG	e
71	230	221	221	222	M2 2	222	M2 1
72	223	224	224	225	M2-4	225	M2-3
73	226	227	227	228	M2-6	228	M2-5
75	232	233	233	234	M2 10	234	M2 9
76	235	236	236	237	M2 12	237	M2 11

NOTE All wires are RED #20 AWG

NOTE These data are confidential and the property of UOP and shall not be disclosed to others or reproduced in any manner or used for any purpose whatsoever except by written permission or as provided in a signed Agreement with UOP relating to such data.

00 00 00 04 11 07

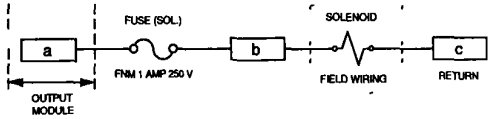
uop
MONIREX® SYSTEMS
25 East Algonquin Road Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER MASTER CONTROLLER

VALVE SOLENOID WIRING 115 VAC

NUMBER	REVISION
8011 7076 1612	0

SHEET 5
BY PBX APP'D
DATE SEPTEMBER 28 1990



BV	a	WIRE TAG	FUSE	WIRE TAG	b	c
71	M12 1	305A	71 SOL.	305	305	306
72	M12 2	308A	72 SOL.	308	308	309
73	M12 3	311A	73 SOL.	311	311	312
75	M12 5	317A	75 SOL.	317	317	318
76	M12-6	320A	76 SOL.	320	320	321

NOTE All wires are BLACK #18 AWG

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00 00 08 04 11 07

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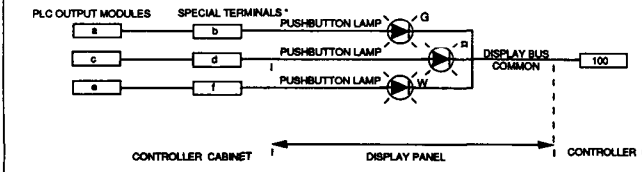
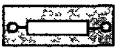


DESCRIPTION	a	WIRE TAG	b	c	WIRE TAG	d	e	WIRE TAG	f
REGENERATOR	M4-17	151	151	M4-18	152	152			
CATALYST FLOW	M4-27	153	153	M4-28	154	154			
CHLORIDE HEATER	M4-19	155	155	M4-20	156	156			
REGENERATOR HEATER	M4-21	157	157	M4-22	158	158			
AIR HEATER	M4-23	159	159	M4-24	160	160			
LH-1 RUN-HOLD	M4-25	161	161	M4-26	162	162			
NITROGEN							M4-9	170	170
AIR							M4-10	171	171
CHLOR DE							M4-11	172	172

SPECIAL TERMINALS *



(WITH BUILT-IN 680 OHM 1 WATT RESISTOR FOR LED CURRENT LIMITING)

NOTE All wires are RED #20 AWG

uop
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER MASTER CONTROLLER
PUSHBUTTON LAMP WIRING

NUMBER 8011 7076 1612
REVISION 0
SHEET 8
BY PBX APPD
DATE SEPTEMBER 28 1990

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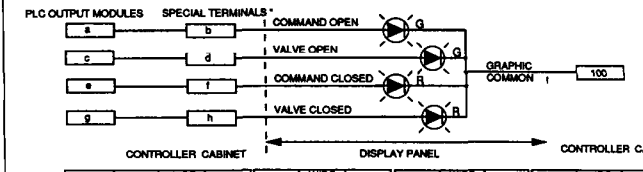
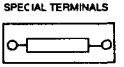


BV	a	WIRE TAG	b	c	WIRE TAG	d	e	WIRE TAG	f	g	WIRE TAG	h
71	M5-1	115	115	M5-2	116	116	M5-3	113	113	M5-4	114	114
72	M5-5	119	119	M5-6	120	120	M5-7	117	117	M5-8	118	118
73	M5-9	123	123	M5-10	124	124	M5-11	121	121	M5-12	122	122
75	M5-17	131	131	M5-18	132	132	M5-19	129	129	M5-20	130	130
76	M5-21	135	135	M5-22	136	136	M5-23	133	133	M5-24	134	134

NOTE All wires are RED #20 AWG

SPECIAL TERMINALS



(WITH BUILT IN 680 OHM 1 WATT RESISTOR FOR LED CURRENT LIMITING)

uop
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER MASTER CONTROLLER
VALVE POSITION INDICATOR WIRING

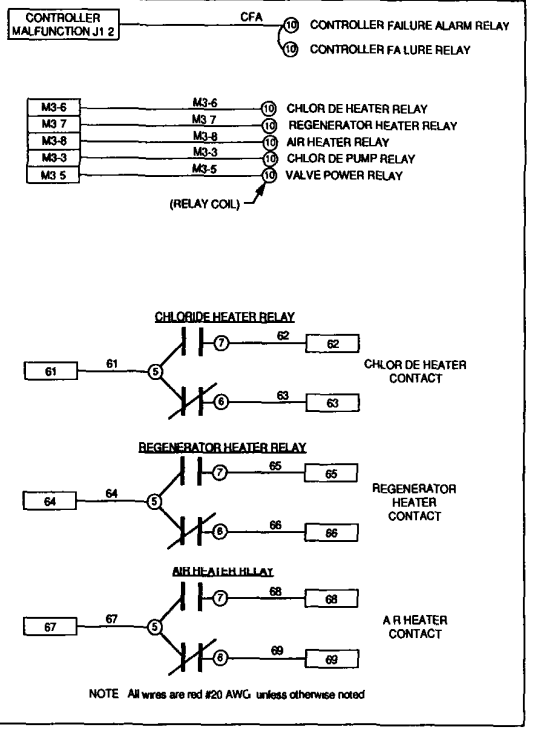
NUMBER 8011 7076 1612
REVISION 0
SHEET 7
BY PBX APPD
DATE SEPTEMBER 28 1990

uop
MONIREX® SYSTEMS
25 East Algonquin Road Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER MASTER CONTROLLER

RELAY WIRING

NUMBER 8011 7076 1612 REVISION 0
SHEET 10
BY PBX APP'D
DATE SEPTEMBER 28 1990



NOTE All wres are red #20 AWG unless otherwise noted

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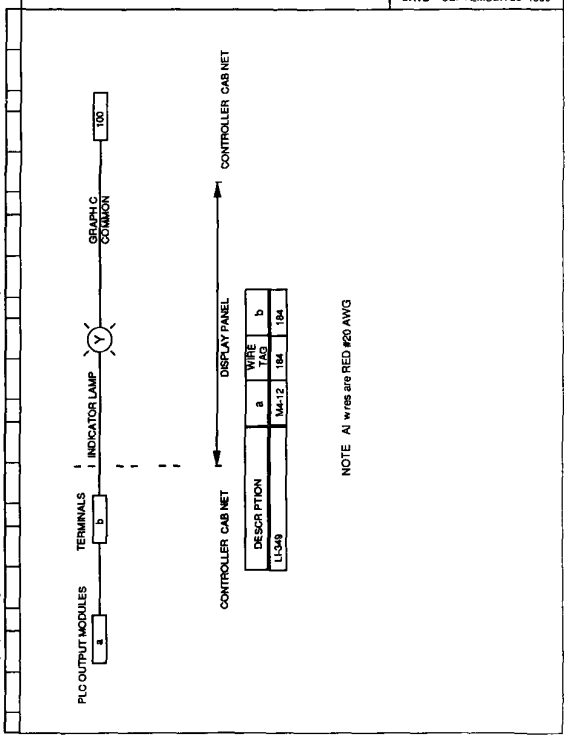
MONIREX® SYSTEMS
25 East Algonquin Road Des Plaines Illinois U.S.A. 60017 5017

CCR LOCK HOPPER MASTER CONTROLLER

INDICATOR LAMP WIR NG

NUMBER 8011 70"6 612 REVISION 0
SHEET 9
BY PBX APP'D
DATE SEPTEMBER 28 1990



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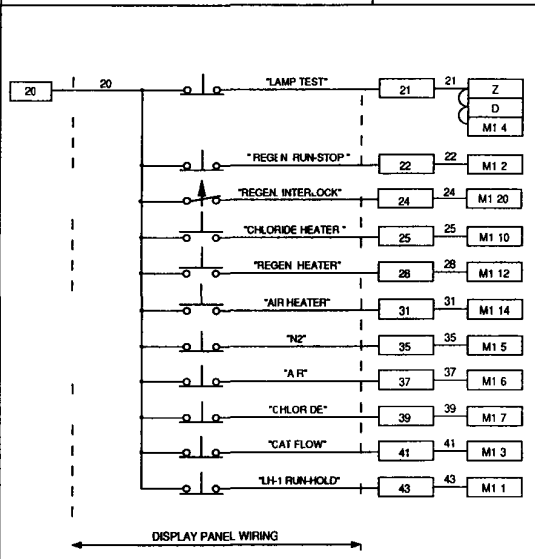
UOP
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER MASTER CONTROLLER

PUSHBUTTON CONTACT INPUT WIRING

NUMBER	REVISION
8011 7076 1612	0

SHEET 12
BY PBX APP'D
DATE SEPTEMBER 28 1990



NOTE All wires are RED #20 AWG

NOTE These data are confiden a and she property of LOP and sha not be d sc osed to others or reproduced n any manner or used for any purpose w a ut ex-p ess by w tten perm ss on or as provided n a s gned agreemen w th LOP relating to such data.

UOP
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

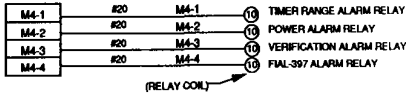
CCR LOCK HOPPER MASTER CONTROLLER

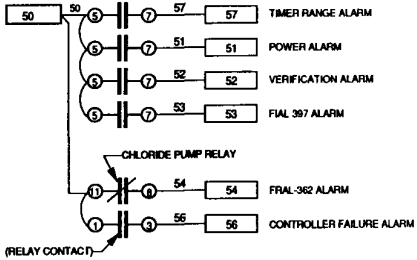
ANNUNCIATOR AND INTERCONNECT WIRING

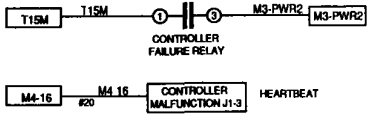
NUMBER	REVISION
8011 7076 1612	0

SHEET 11
BY PBX APP'D
DATE SEPTEMBER 28 1990

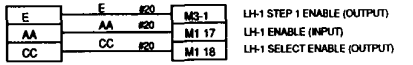
ANNUNCIATOR WIRING







INTERCONNECT WIRING



NOTE 1 All wires are RED #18 AWG unless otherwise noted

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UOP MONIREX SYSTEMS DRAWINGS
LOCK HOPPER #1 CONTROLLER

DWG NO	TITLE
8011 7076 1612	
SHEET 14	AC Power W r ng
SHEET 15	Valve Power W nng AC
SHEET 16	DC Power W r ng
SHEET 17	DC Return W r ng
SHEET 18	Valve Command to nterlock System W r ng
SHEET 19	Valve Solenoid W r ng 115VAC
SHEET 20	Valve L mit Switch W r ng
SHEET 21	Valve Position ndicator W nng
SHEET 22	Lamp and Transfer Counter W r ng
SHEET 23	Switch Contact nput Contact W r ng
SHEET 24	Annunc a or Reply and nterconnect W nng

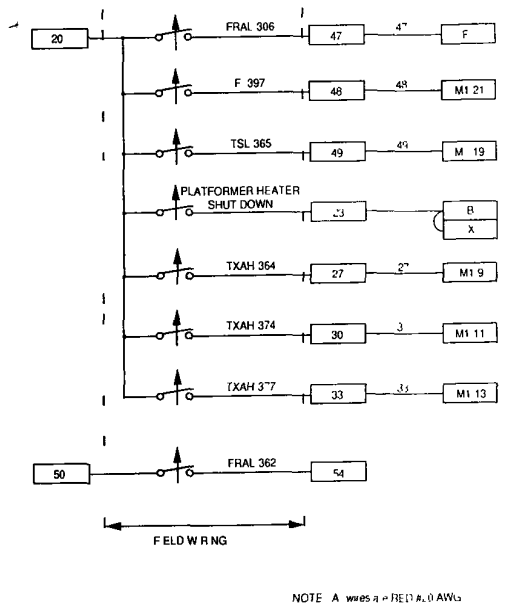
uop

uop
MONIREX® SYSTEMS
25 Eas Algonquin Road Des Plaines Illinois U.S.A 600 7 501

CCR LOCK HOPPER MASTER CONTROLLER

SW TCH CONTACT INPUT WIRING

8011 [illegible] 612 0
SHEET 13
BY PBX APP'D
DATE SEPTEMBER 28 1990



NOTE A wes a PRED #.0 AWG

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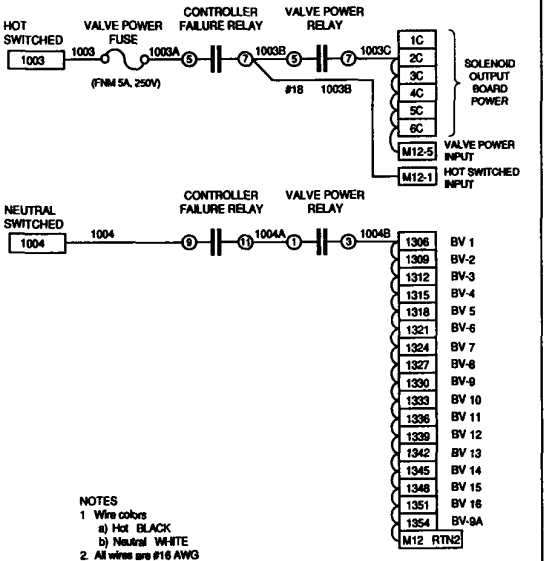
UOP
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROLLER # 1

VALVE POWER WIRING - AC

NUMBER	REVISION
8011 7076 1612	0

SHEET 15
BY PBX APP'D
DATE SEPTEMBER 28 1990



NOTES
1 Wire colors
a) Hot BLACK
b) Neutral WHITE
2. All wires are #16 AWG unless otherwise noted

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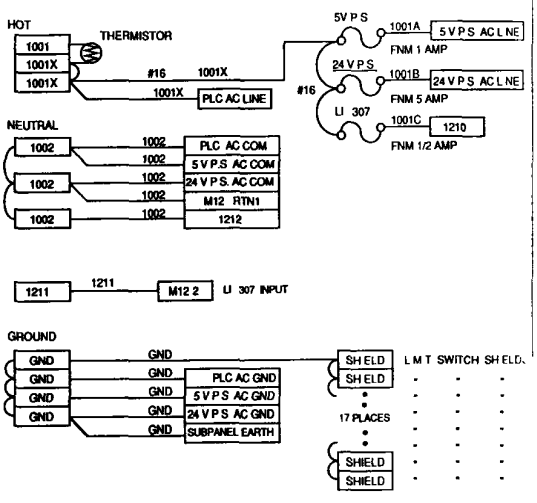
UOP
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROLLER # 1

AC POWER WIRING

NUMBER	REVISION
8011 7076 1612	0

SHEET 14
BY PBX APP'D
DATE SEPTEMBER 28 1990



NOTES
1 Wire colors
a) Hot BLACK
b) Neutral WHITE
c) Ground GREEN
2. All wires are #18 AWG unless otherwise noted
3 PLC power supply interna jumper set for 115 VAC

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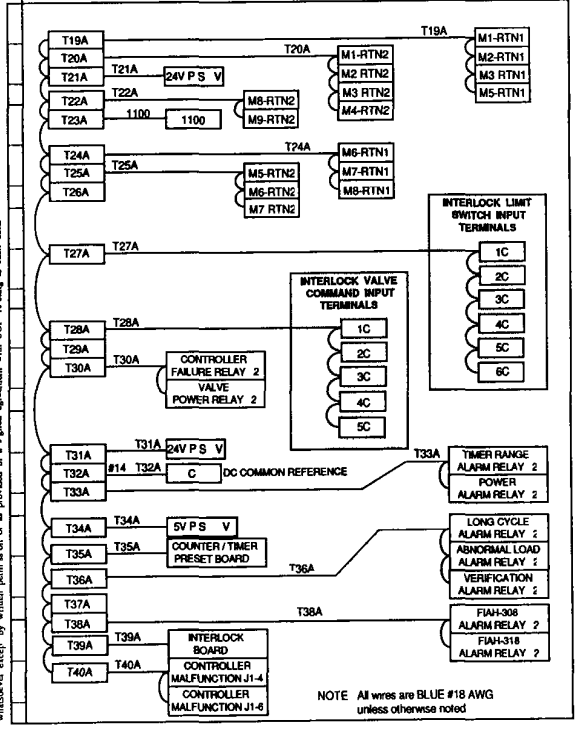
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

NUMBER 8011 7076 1612 REVISION 0
SHEET 17
BY PBX APP'D
DATE SEPTEMBER 28 1990

CCR LOCK HOPPER CONTROLLER # 1

DC RETURN WIRING



NOTE All wires are BLUE #18 AWG unless otherwise noted

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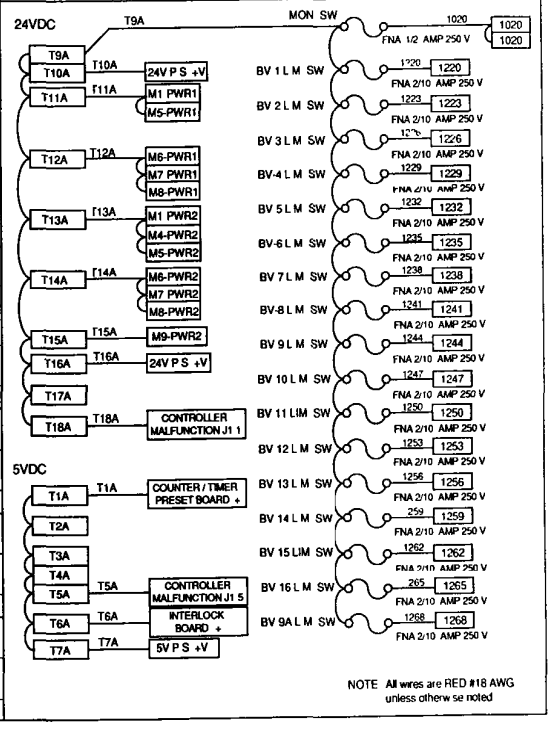
MONIREX® SYSTEMS
25 East Algonquin Road Des Plaines Illinois U.S.A. 60017-5017

NUMBER 8011 7076 1612 REVISION 0
SHEET 16
BY PBX APP'D
DATE SEPTEMBER 28 1990

CCR LOCK HOPPER CONTROLLER # 1

DC POWER WIRING



NOTE All wires are RED #18 AWG unless otherwise noted

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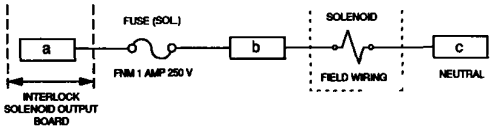
00 00 16 04 11 07

UOP
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

NUMBER 8011 7076 1612 REVISION 0
SHEET 19
BY PBX APP'D
DATE SEPTEMBER 28, 1990

CCR LOCK HOPPER CONTROLLER # 1

VALVE SOLENOID WIRING 115 VAC



BV	a	WIRE TAG	FUSE	WIRE TAG	b	c
1	5	1305A	1 SOL.	1305	1305	1306
2	6	1308A	2 SOL.	1308	1308	1309
3	7	1311A	3 SOL.	1311	1311	1312
4	8	1314A	4 SOL.	1314	1314	1315
5	9	1317A	5 SOL.	1317	1317	1318
6	10	1320A	6 SOL.	1320	1320	1321
7	11	1323A	7 SOL.	1323	1323	1324
8	12	1326A	8 SOL.	1326	1326	1327
9	13	1329A	9 SOL.	1329	1329	1330
10	15	1332A	10 SOL.	1332	1332	1333
11	16	1335A	11 SOL.	1335	1335	1336
12	17	1338A	12 SOL.	1338	1338	1339
13	18	1341A	13 SOL.	1341	1341	1342
14	19	1344A	14 SOL.	1344	1344	1345
15	20	1347A	15 SOL.	1347	1347	1348
16	21	1350A	16 SOL.	1350	1350	1351
9A	14	1353A	9A SOL.	1353	1353	1354

NOTE All wires are BLACK #18 AWG.

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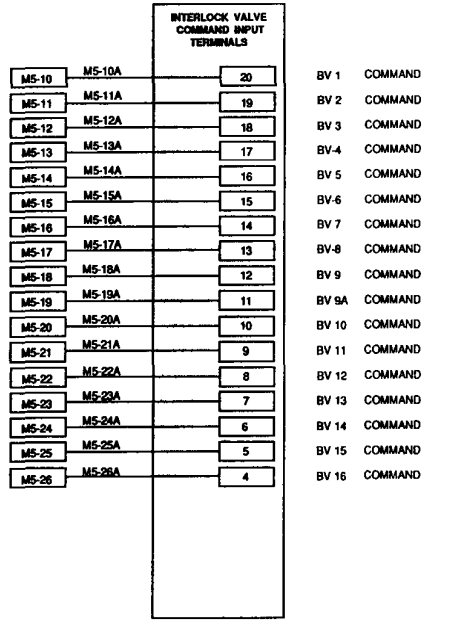
UOP
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

NUMBER 8011 7076 1612 REVISION 0
SHEET 18
BY PBX APP'D
DATE SEPTEMBER 28 1990

CCR LOCK HOPPER CONTROLLER # 1

VALVE COMMAND TO INTERLOCK SYSTEM WIRING



NOTE All wires are RED #20 AWG

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00 00 13 04 11 07

00 00 13 04 11 07

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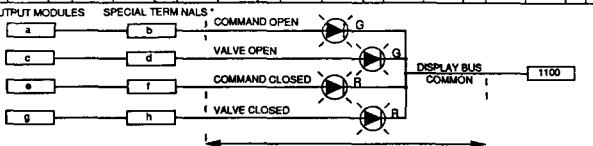

BV	a	WIRE TAG	b	c	WIRE TAG	d	e	WIRE TAG	f	g	WIRE TAG	h
1	M6-29	1103	1103	M6-30	1104	1104	M6-31	1105	1105	M6-32	1106	1106
2	M7 1	1109	1109	M7-2	1110	1110	M7-3	1107	1107	M7-4	1108	1108
3	M7-5	1113	1113	M7-6	1114	1114	M7 7	1111	1111	M7-8	1112	1112
4	M7 9	1115	1115	M7 10	1116	1116	M7 11	1117	1117	M7 12	1118	1118
5	M7 13	1121	1121	M7 14	1122	1122	M7-15	1119	1119	M7 16	1120	1120
6	M7 17	1125	1125	M7 18	1126	1126	M7 19	1123	1123	M7-20	1124	1124
7	M7 21	1127	1127	M7 22	1128	1128	M7 23	1129	1129	M7 24	1130	1130
8	M7 25	1133	1133	M7 26	1134	1134	M7 27	1131	1131	M7-28	1132	1132
9	M7-29	1137	1137	M7-30	1138	1138	M7-31	1135	1135	M7-32	1136	1136
10	M8-5	1141	1141	M8-6	1142	1142	M8-7	1139	1139	M8-8	1140	1140
11	M8-9	1143	1143	M8-10	1144	1144	M8-11	1145	1145	M8 12	1146	1146
12	M8-13	1149	1149	M8-14	1150	1150	M8-15	1147	1147	M8 16	1148	1148
13	M8-17	1153	1153	M8-18	1154	1154	M8-19	1151	1151	M8-20	1152	1152
14	M8-21	1157	1157	M8-22	1158	1158	M8-23	1155	1155	M8-24	1156	1156
15	M8-25	1159	1159	M8-26	1160	1160	M8-27	1161	1161	M8-28	1162	1162
16	M8-29	1165	1165	M8-30	1166	1166	M8-31	1163	1163	M8-32	1164	1164
9A	M8 1	1169	1169	M8-2	1170	1170	M8-3	1167	1167	M8-4	1168	1168

NOTES 1 All wires are RED #20 AWG
2 * Specia terminals see sheet 7 for details

uop
MONIREX® SYSTEMS
25 East Algonquin Road Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROLLER #1

VALVE POSITION INDICATOR WIRING

NUMBER 8011 7076 1612 REVISION 0
SHEET 21
BY PBX APPD
DATE SEPTEMBER 28 1990

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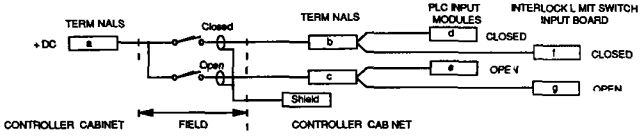

	CLOSED			OPEN			CLOSED			OPEN		
BV	a	b	WIRE TAG	d	c	WIRE TAG	e	b	WIRE TAG	f	c	WIRE TAG	g	SH ELD
1	1220	1221	1221	M2-22	1222	1222	M2-21							Shield
2	1223	1224	1224	M2-24	1225	1225	M2 23							Shield
3	1226	1227	1227	M2-26	1228	1228	M2 25	1227	1227	2	1228	1228	1	Shield
4	1229	1230	1230	M2 28	1231	1231	M2-27	1230	1230	4	1231	1231	3	Shield
5	1232	1233	1233	M2-30	1234	1234	M2 29	1233	1233	6	1234	1234	5	Shield
6	1235	1236	1236	M2-32	1237	1237	M2-31	1236	1236	7				Shield
7	1238	1239	1239	M3 2	1240	1240	M3 1	1239	1239	9	1240	1240	8	Shield
8	1241	242	1242	M3-4	1243	1243	M3 3	1242	1242	10				Shield
9	1244	1245	1245	M3-6	1246	1246	M3-5	1245	1245	4	246	246	*5	Shield
10	1247	1248	1248	M3-10	1249	1249	M3 9	1248	1248	11				Shield
1	1250	1251	1251	M3-12	1252	1252	M3- 1	1251	1251	13	252	1252	12	Shield
12	1253	1254	1254	M3-14	1255	1255	M3-13	1254	1254	8				Shield
13	1256	1257	1257	M3-16	1258	1258	M3-15							Shield
14	1259	1260	1260	M3-18	1261	126	M3-17	1260	1260	20	261	261	19	Shield
5	1262	263	1263	M3-20	1264	1264	M3-19	1263	263	22	264	1264	21	Shield
16	1265	1266	1266	M3-22	1267	1267	M3-2	1266	1266	24	267	1267	23	Shield
9A	268	269	1269	M3-8	1270	1270	M3 7	1269	1269	17	1270	1270	18	Shield

NOTE All wires are RED #20 AWG

uop
MONIREX® SYSTEMS
25 East Algonquin Road Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROLLER #1

VALVE LIMIT SWITCH WIRING

NUMBER 8011 7076 1612 REVISION 0
SHEET 20
BY PBX APPD
DATE SEPTEMBER 28 1990

00 00 15 04 11 07

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CCR LOCK HOPPER CONTROLLER #1

SWITCH CONTACT INPUT WIRING

NUMBER	REVISION
8011 7076 1612	0

SHEET 23

BY PBX APPD

DATE SEPTEMBER 28, 1990

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DESCR PTION	a	WIRE TAG	b	c	WIRE TAG	d	e	WIRE TAG	f	g	WIRE TAG	h
LI-307	M6-11	1183	1183									
READY	M6 1	1190	1190									
PURGE	M6 2	1191	1191									
UNLOAD	M6 3	1192	1192									
PRESSURE	M6-4	1193	1193									
LOAD	M6 5	1194	1194									
LOCK HOPPER #1				M6-12	1101	1101						
LOCK HOPPER #1							M6-13	1102	1102			
XFER COUNTER										M6-15	1198	1198

NOTES 1 All wires are RED #20 AWG
2 * Specia term nals see sheet 7 for deta ls

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MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROLLER #1

LAMP AND TRANSFER COUNTER WIRING

NUMBER	REVISION
8011 7076 1612	0

SHEET 22

BY PBX APPD

DATE SEPTEMBER 28, 1990

UOP MONIREX SYSTEMS DRAWINGS
LOCK HOPPER #2 CONTROLLER

DWG NO	TITLE
80 1 7076 1612	
SHEET 25	AC Power W r ng
SHEET 26	Valve Power W r ng AC
SHEET 27	DC Power W nng
SHEET 28	DC Re'u m W r ng
SHEET 29	Valve Command to nterlock System Wiring
SHEET 30	Valve Solenoid W nng 115VAC
SHEET 31	Valve L mit Switch Wr ng
SHEET 32	Valve Position Indicator W nng
SHEET 33	Lamp and Transfer Coun er W r ng
SHEET 34	Switch Contact npu Contact Wiring
SHEET 35	Annunciator Reply and nterconnect Wr ng

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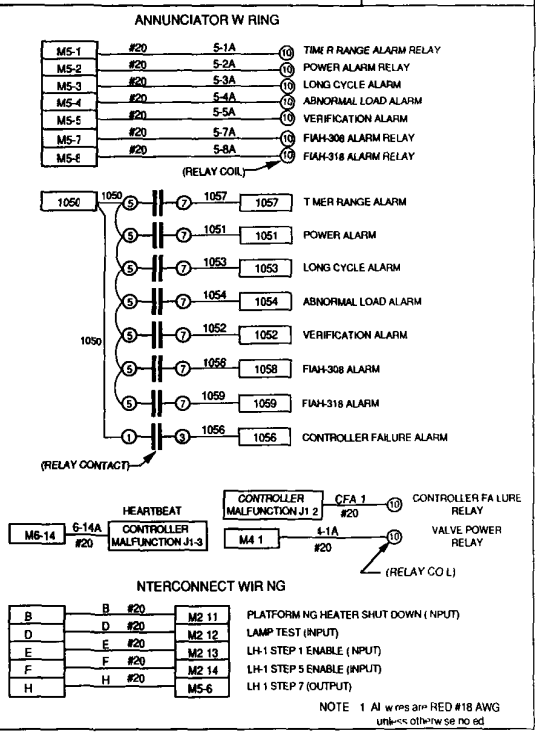
25 East Algonquin Road Des Plaines Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROLLER # 1

ANNUNCIATOR RELAY AND INTERCONNECT WIRING

NUMBER 8011 7076 1612 REVISION 0
SHEET 24
BY PBX APP'D
DATE SEPTEMBER 28 1990



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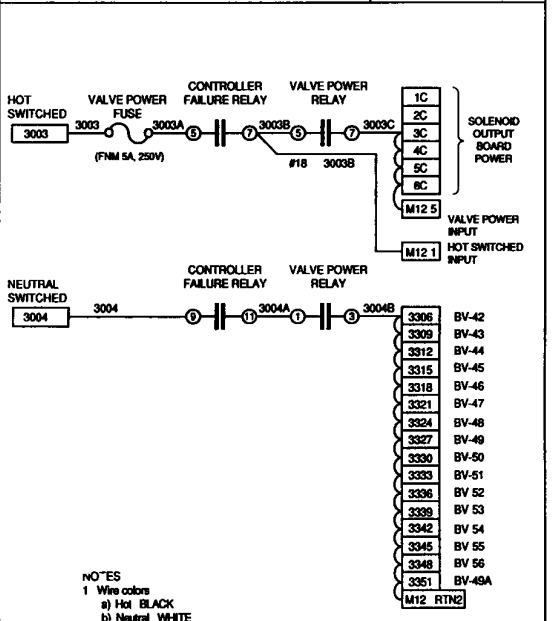
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROLLER # 2

VALVE POWER WIRING - AC

NUMBER	REVISION
8011 7076 1612	0

SHEET 26
BY PBX APP'D
DATE SEPTEMBER 28 1990



NOTES
1. Wire colors
   a) Hot BLACK
   b) Neutral WHITE
2. All wires are #16 AWG unless otherwise noted

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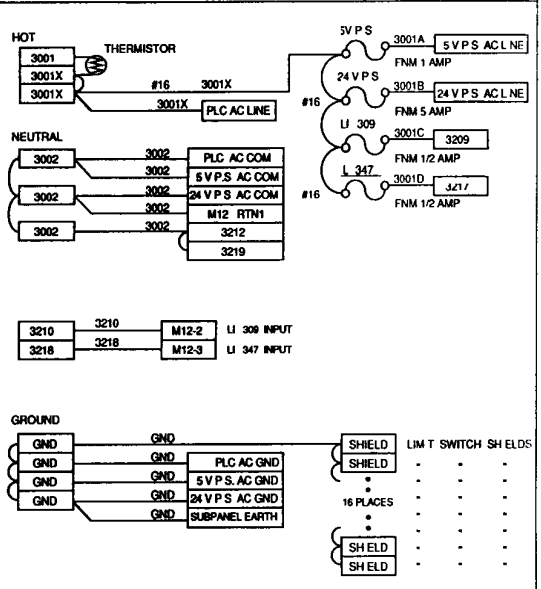
CCR LOCK HOPPER CONTROLLER # 2

AC POWER WIRING

NUMBER	REVISION
8011 7076 1612	0

SHEET 25
BY PBX APP'D
DATE SEPTEMBER 28 1990



NOTES
1. Wire colors
   a) Hot BLACK
   b) Neutral WH TE
   c) Ground GREEN
2. All wires are #18 AWG unless o herwise noted
3. PLC power supply interna jumper set for 115 VAC

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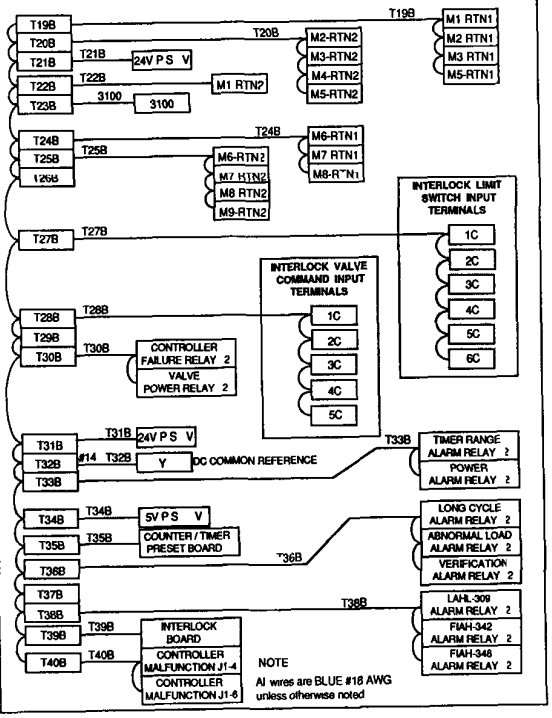
CCR LOCK HOPPER CONTROLLER #2

DC RETURN WIRING

NUMBER 8011 7076 1612 REVISION 0
SHEET 28
BY PBX APP'D
DATE SEPTEMBER 28 1990



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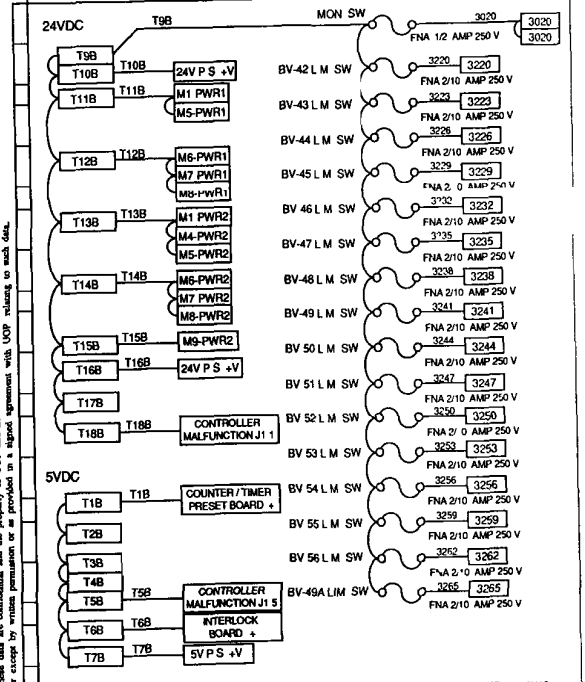
MONIREX® SYSTEMS
25 East Algonquin Road Des Plaines, Illinois U.S.A. 60017 50 7

CCR LOCK HOPPER CONTROLLER #2

DC POWER WIRING

NUMBER 8011 70'6 1612 REVISION 0
SHEET 27
BY PBX APP'D
DATE SEPTEMBER 28 1990



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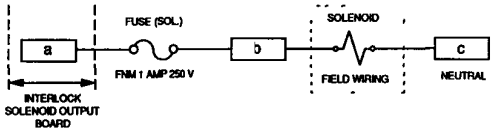
MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

NUMBER 8011 7076 1612 REVISION 0
SHEET 30
BY PBX APP'D
DATE SEPTEMBER 28 1990

CCR LOCK HOPPER CONTROLLER # 2

VALVE SOLENOID WIRING 115 VAC



BV	a	WIRE TAG	FUSE	WIRE TAG	b	c
42	9	3305A	42 SOL.	3305	3305	3306
43	10	3308A	43 SOL.	3308	3308	3309
44	11	3311A	44 SOL.	3311	3311	3312
45	12	3314A	45 SOL.	3314	3314	3315
46	13	3317A	46 SOL.	3317	3317	3318
47	14	3320A	47 SOL.	3320	3320	3321
48	15	3323A	48 SOL.	3323	3323	3324
49	16	3326A	49 SOL.	3326	3326	3327
50	18	3329A	50 SOL.	3329	3329	3330
51	19	3332A	51 SOL.	3332	3332	3333
52	20	3335A	52 SOL.	3335	3335	3336
53	21	3338A	53 SOL.	3338	3338	3339
54	22	3341A	54 SOL.	3341	3341	3342
55	23	3344A	55 SOL.	3344	3344	3345
56	24	3347A	56 SOL.	3347	3347	3348
49A	17	3350A	49A SOL.	3350	3350	3351

NOTE All wires are BLACK #18 AWG.

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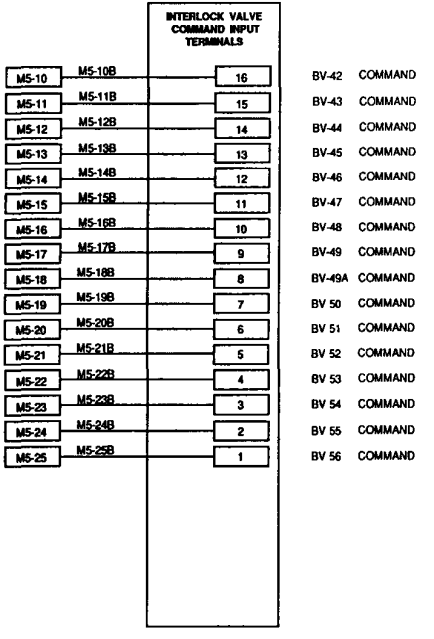
UOP
MONIREX® SYSTEMS
25 East Algonquin Road Des Plaines, Illinois U.S.A. 60017-5017

NUMBER 8011 7076 612 REVISION 0
SHEET 29
BY PBX APP'D
DATE SEPTEMBER 28 1990

CCR LOCK HOPPER CONTROLLER # 2

VALVE COMMAND TO INTERLOCK SYSTEM WIRING



NOTE All wires are RED #20 AWG

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00 00 19 04 11 07

00 00 19 04 11 07

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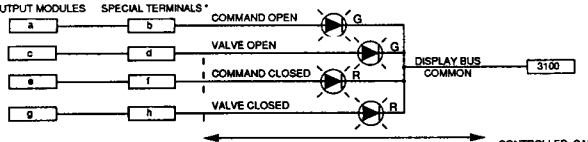

BV	a	WIRE TAG	b	c	WIRE TAG	d	e	WIRE TAG	f	g	WIRE TAG	h
42	M7 1	3105	3105	M7 2	3106	3106	M7-3	3103	3103	M7-4	3104	3104
43	M7-5	3109	3109	M7-6	3110	3110	M7 7	3107	3107	M7-8	3108	3108
44	M7-9	3111	3111	M7 10	3112	3112	M7 11	3113	3113	M7 12	3114	3114
45	M7 13	3117	3117	M7 14	3118	3118	M7 15	3115	3115	M7 16	3116	3116
46	M7 17	3121	3121	M7 18	3122	3122	M7 19	3119	3119	M7-20	3120	3120
47	M7 21	3123	3123	M7-22	3124	3124	M7-23	3125	3125	M7 24	3126	3126
48	M7 25	3129	3129	M7-26	3130	3130	M7 27	3127	3127	M7-28	3128	3128
49	M7-29	3133	3133	M7-30	3134	3134	M7-31	3131	3131	M7-32	3132	3132
50	M8-5	3137	3137	M8-6	3138	3138	M8-7	3135	3135	M8-8	3136	3136
51	M8-9	3139	3139	M8-10	3140	3140	M8-11	3141	3141	M8-12	3142	3142
52	M8-13	3145	3145	M8-14	3146	3146	M8-15	3143	3143	M8-16	3144	3144
53	M8-17	3149	3149	M8-18	3150	3150	M8-19	3147	3147	M8-20	3148	3148
54	M8-21	3153	3153	M8-22	3154	3154	M8-23	3151	3151	M8-24	3152	3152
55	M8-25	3155	3155	M8-26	3156	3156	M8-27	3157	3157	M8-28	3158	3158
56	M8-29	3161	3161	M8-30	3162	3162	M8-31	3159	3159	M8-32	3160	3160
49A	M8-1	3165	3165	M8-2	3166	3166	M8-3	3163	3163	M8-4	3164	3164

NOTES 1 All wires are RED #20 AWG
2 * Special terminals, see sheet 7 for details

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MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROLLER # 2

VALVE POSITION INDICATOR WIRING

NUMBER 8011 7076 1612
REVISION 0
SHEET 32
BY PBX
APPD
DATE SEPTEMBER 28 1990

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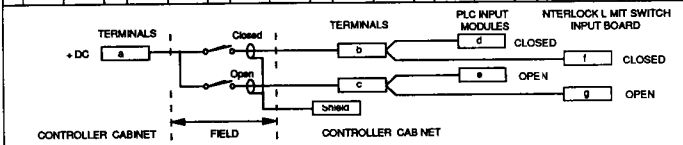

	CLOSED			OPEN			CLOSED			OPEN			
BV	a	b	WIRE TAG	d	c	WIRE TAG	e	b	WIRE TAG	f	c	WIRE TAG	g	SHIELD
42	3220	3221	3221	M3-2	3222	3222	M3 1							Shield
43	3223	3224	3224	M3-4	3225	3225	M3-3	3224	3224	2	3225	3225	1	Shield
44	3226	3227	3227	M3-6	3228	3228	M3-5	3227	3227	4	3228	3228	3	Shield
45	3229	3230	3230	M3-8	3231	3231	M3-7	3230	3230	6	3231	3231	5	Shield
46	3232	3233	3233	M3-10	3234	3234	M3 9	3233	3233	7				Shield
47	3235	3236	3236	M3-12	3237	3237	M3-11	3236	3236	9	3237	3237	8	Shield
48	3238	3239	3239	M3-14	3240	3240	M3-13	3239	3239	10				Shield
49	3241	3242	3242	M3-16	3243	3243	M3-15	3242	3242	12	3243	3243	11	Shield
50	3244	3245	3245	M3 20	3246	3246	M3 19	3245	3245	15				Shield
51	3247	3248	3248	M3-22	3249	3249	M3-21	3248	3248	7	3249	3249	16	Shield
52	3250	3251	3251	M3-24	3252	3252	M3-23	3251	3251	18				Shield
53	3253	3254	3254	M3-26	3255	3255	M3-25							Shield
54	3256	3257	3257	M3-28	3258	3258	M3-27	3257	3257	20	3258	3258	19	Shield
55	3259	3260	3260	M3-30	3261	3261	M3-29	3260	3260	22	3261	3261	21	Shield
56	3262	3263	3263	M3-32	3264	3264	M3-31	3263	3263	24	3264	3264	23	Shield
49A	3265	3266	3266	M3-18	3267	3267	M3 17	3266	3266	4	3267	3267	3	Shield

NOTE All wires are RED #20 AWG

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MONIREX® SYSTEMS
25 East Algonquin Road, Des Plaines Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROLLER # 2

VALVE LIMIT SWITCH WIRING

NUMBER 8011 7076 1612
REVISION 0
SHEET 31
BY PBX
APPD
DATE SEPTEMBER 28 1990

00 00 21 04 11 07

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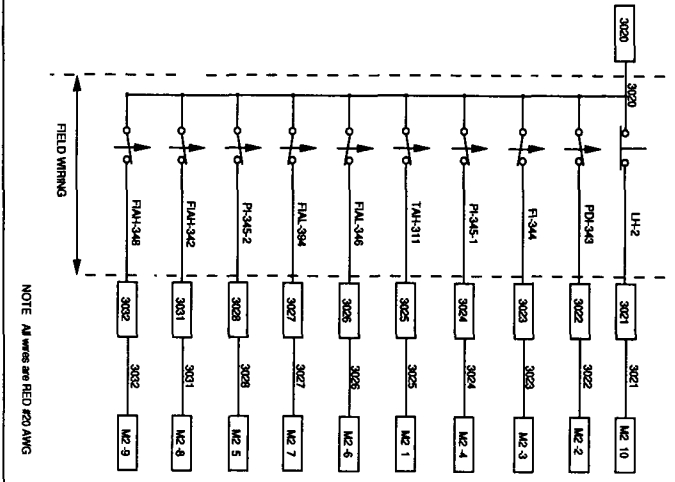
UOP MONITREX SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROLLER #2
SWITCH CONTACT INPUT WIRING

DRAWING NUMBER 8011 7076 1612 REVISION 0
SHEET 34
BY PBX APPD
DATE SEPTEMBER 28 1990



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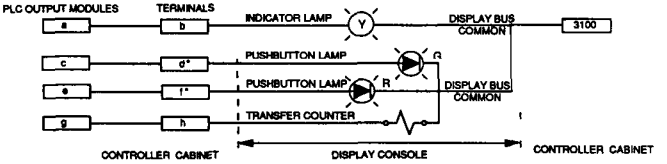
UOP MONITREX SYSTEMS
25 East Algonquin Road, Des Plaines, Illinois U.S.A. 60017-5017

CCR LOCK HOPPER CONTROLLER #2
LAMP AND TRANSFER COUNTER WIRING

DRAWING NUMBER 8011 7076 1612 REVISION 0
SHEET 33
BY PBX APPD
DATE SEPTEMBER 28 1990



DESCRIPTION	a	WIRE TAG	b	c	WIRE TAG	d	e	WIRE TAG	f	g	WIRE TAG	h
LI-309	M6-8	3184	3184									
LI-347	M6-13	3183	3183									
READY	M6-1	3190	3190									
PURGE 1	M6-2	3191	3191									
PRESSURE	M6-3	3192	3192									
UNLOAD	M6-4	3193	3193									
PURGE 2	M6 5	3194	3194									
LOAD	M6 6	3195	3195									
LOCK HOPPER #2				M6-15	3101	3101						
LOCK HOPPER #2							M6-16	3102	3 02			
#2 XFER COUNTER										M6- 8	3 98	3 98

1 All wires are RED #20 AWG
2 * Spec a erm na s see sheet 7 for deta ls

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MONIREX® SYSTEMS
25 East Algonquin Road Des Plaines Illinois U.S.A. 600 7 50 7

DCR LOCK HOPPER CONTROLLER # 2

ANNUNC ATOR RELAY AND INTERCONNECT W R NG

8011 [illegible] 0
SHEET
BY PBY APP'D
DATE MBER 8 [illegible]

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ANNUNC ATOR W R NG

M5-2	#20	5-2B	10	T MER RANGE ALARM RELAY
M5-3	#20	5-3B	10	POWER ALARM RELAY
M5-4	#20	5-4B	10	LONG CYCLE ALARM
M5-5	#20	5-5B	10	ABNORMAL LOAD ALARM
M5 6	#20	5-6B	10	VER F CATION ALARM
M5-1	#20	5-1B	10	LAHL 309 ALARM RELAY
M5-8	#20	5 8B	10	F AH 342 ALARM RELAY
M5-9	#20	5 9B	D	FIAH 348 ALARM RELAY

RE AY OIL

3050	3050	5	7	3057	3057 T MER RA ge ALAHM
		5	7	3051	3051 POWER A_ARM
		5	7	3053	3053 LONG CYCLE ALARM
		5	7	3054	3054 ABNORMAL LOAD ALARM
	3050	5	7	3052	3052 VERIF CATION ALARM
		5	7	3055	3055 LAHL 309 ALARM
		5	7	3058	3058 F AH 342 ALARM
		5	7	3059	3059 FIAH 348 ALARM
		1	3	3056	3056 CONTROLLER FA URE ALA M

(RELAY CONTACT)

HEARTBEAT

M6-17	3-17B #20	CONTROLLER MALFUNCTION J1 3	CONTROLLER MALFUNCTION J 2	CFA 2 #20 CONTROLLER FAILURE RELAY
			M4 1	4 1B #20 VALVE POWER RELA

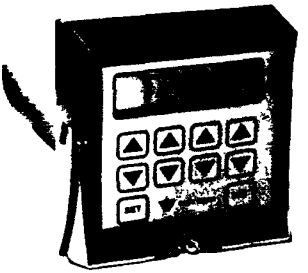
RELAY OIL

NTERCONNECT W R NG

H	H #20	M2 13	LH 1 STEP 7 NPUT
X	X #20	M2 11	PLATFORM NG HEATER SH T DOWN T
Z	Z #20	M2 12	LAMP TEST NPUT)
AA	AA #20	M6-19	LH 1 ENABLE OUTPUT)
CC	CC #20	M6-20	LH 1 SELECT ENABLE (OUTPUT)

NOTE: ALL WIRES TO BE #20 AWG UNLESS OTHERWISE NOTED

CX200 SERIES
MICROPROCESSOR BASED
SOLID STATE TIMER/COUNTER



The CX200 s a m croprocessor based timer/counter housed n a standard 15 term na CYCL FLEX® plug n case T me or count operat on time range and standard or reverse start operation s selected by 7 m n ature rocker switches located n side the un t housing Time or count setpoints are entered nto the unit using a sea ed membrane keypad on the front of the un t Each d git n the setpo nt s nd v dua ly ncreased or decreased by press ng the appropr ate keypad switch T me or count setpo nt and progress is d splayed on the front of the un t by a 4½ d git qu d crystal disp ay Operat ona mode annunciators a so appear in the disp ay area on the front of the unit The mode annunciator f ashes when the un t s t m ng or count ng

F ve time ranges from *9 999 seco ds to *99 hrs 59 min and two count rates are available Each count rate w accept and d splay counts from 1 to 19999

The CX200 timer/counter has two relay outputs one 10 ampere 2 po e form C instantaneous contacts and one 10 ampere 2 po e form C de ayed contacts The relays are socket mounted for easy replacement The CX240 cont gurat on has one N O so id state MOSFET de ayed act on switch rated at 1 ampere cont nuous oad current 0-264 VAC 50/60 Hz or DC The MOSFET output has an ON resistance of 0 5 ohm and a very ow OFF leakage mak ng the output deal for switching low eve signals as wel as h gh voltage oads The delayed outputs can be programmed to operate in one of four load sequences OOX OXO OOX w th pulse output and OOX pulse output w th repeat cycle operat on

Standard start s defined as an ON de ay reset t mer or counter On standard start units the t mer/counter resets on power fa ure Reverse start or OFF de ay un ts w not reset on power fa ure and w cont nue the cyc e when power s restored **CAUTION The product label should always be marked o indicate the start mode of operation of the unit**

Time/Count Range

SYM	MAXIMUM RANGE	MINIMUM SETTING	COUNT RATE
1	19999 Cts	1 Count	500 Max AC
2	19999Cts	1 Count	5000/Min AC
3	199 99 Sec	01 Sec	
4	1999 9 Sec	1 Sec	
5	19 999 Sec	0 001 Sec	
6	199 Min 59 Sec	1 Sec	
7	199 Hr 59 Min	1 Min	

Time Inhibit/Count Line Voltage & Frequency
SYMBOL VOLTAGE & FREQUENCY
A6 120 VAC 50/60 Hz
B6 240 VAC 50/60 Hz

Setting Accuracy
Count — 100%
T me ± 0 1% or 50ms whichever s arger (0° to 60°C)

Repeat Accuracy
Count 100%
T me - 003% or 35ms wh chever s arger (0° to 60°C)

Reset Time
30 ms fo ow ng vo tage remova from s mu ated c utch nput (CR1)

Operating Temperature
-32° to +140°F (0° to 60°C)

Operating Voltage/Frequency
SYMBOL VOLTAGE & FREQUENCY
A6 120 VAC 50/60 Hz
B6 240 VAC 50/60 Hz

Output Rating
Re ay 10 Amp 120 VAC
Mechanica L fe 20 m hon operat ons
E ectr ca L fe cont ngent upon controlled oad
Sol d State 1 amp 0 264 VAC VDC

Vibration
Un t funct on s unaffected by 2 5G s nusoida v brat on magnitude n both d rections of the perpendicu ar mounting axes mposed from 10 to 100 Hz

Static Discharge
Un t operat on unaffected by a constant 3600 vo t peak 60 Hz d scharge app ed to the grounded front p ate of he unit at a relat ve hum d ty of less than 25%

Battery Life
The CX uses a th um battery w th an expected fe of 10 years

Eagle Signal Controls
A Mark V ndustr es Company
8004 Cameron Road Aust n Texas 78753 U S A

OPERATION

Programming Procedure

A series of 7 miniature rocker switches located inside the unit's housing are used to program the time/count range and the load sequence of the CX200 Timer Counter. The following table defines the switch conditions to program the operating parameters. **CAUTION: The product label should always be marked to indicate the operating mode of the unit.**

Sym	TIME OR COUNT INPUT RANGE	SW TCH NUMBER 1	2	3	4	5	6	7	Notes
1	COUNT 500 Min			O	X	X			a
2	COUNT 5000 Min			X	O	X			a
3	TIME 01 Sec			O	O	X			
4	TIME 0 Sec			X	X	O			
5	TIME 0 001 Sec			O	X	O			
6	TIME Min/Sec			X	O	O			
7	TIME Hrs/Min			O	O	O			
	OUTPUT SEQUENCE								
1	OOX	X	X						
2	OXO	C	X						
3	OO[X] Pulse Output	X	O						
4	OO[X] Repeat Cycle	C	O						
	BATTERY								
1	Battery ON						X		b
2	Battery OFF						O		b
	START MODE								
	Standard Start							O	
	Reverse Start							X	

X Switch ON O Switch OFF Blank Don't Care

NOTES

a. When programmed for count range 1 or 2, counts are registered when voltage is removed (trailing edge) from Count Line. Range should be used whenever possible to provide the best protection from contact bounce of the count source.

b. Battery should be switched off for storage or shipment. Battery should be switched on for proper operation of CX200 unit.

Entering and Displaying Setpoints

Whenever the CX200 unit is powered up and the previous setpoint has been lost, the digital display indicates four hyphens. The unit will not operate until it has been provided with a setpoint, causing the display to flash hyphens.

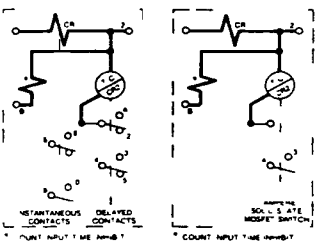
To change a setpoint, press the **SET** key. The setpoint and any associated annunciator lights will be displayed and the panel keypads become active. The operation of the timing or counting function and the output loads are unaffected. For setpoint changes, the SET indicator appears in the graphics panel. The setpoint is changed by pressing appropriate △ or ▽ keypads. Pressing a △ key increments the selected digit indicated above the key. If the △ key is depressed, the digit will change every .5 second until the pad is released. The display will carry to the digit on the left on the 9 to 0 transitions when using the △ pads. The display will borrow from the digits on the left on the 0 to 9 transitions when using the ▽ pads. On ranges 6 and 7, the display will carry on the 59 to 00 transition and borrow on the 00 to 59 transition of the two least significant digits.

When the desired setpoint is displayed, touch the **ENT** key. The new setpoint is entered, all △ and ▽ keys become inoperable and **SET** disappears from the graphics panel. If a new setpoint is entered when the unit is reset, the new setpoint will be in effect upon the next reset.

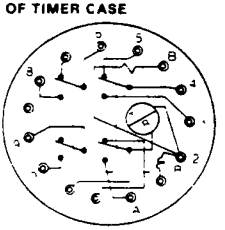
The setpoint may be displayed at any time without disturbing the timing or counting cycle by pressing **SET**. The actual value is returned by pressing **ENT**. If the unit is set at 0000, the load is always ON if programmed for OOX and always OFF if programmed OXO.

A keypad lock is provided on the CX200 Timer Counter to prevent unauthorized tampering. To initiate the keypad lock, press the word **SIGNAL** in the Eagle Signal logo for 8 seconds. To disable the lock to change setpoints, remove power from pin 11 and disconnect or turn the battery off. The unit will lose all setpoints and they must be re-entered for further operation.

CX200 TERMINAL ASSIGNMENTS



TERMINALS AND WIRING DIAGRAM ON REAR OF TIMER CASE



AMF
POTTER & BRUMFIELD RELAYS

KR

KRP

KR-KRP series

MEDIUM POWER 5 and 10 AMP MULTICONTACT AC or DC RELAY

UL File E22575
CSA File 15734

ENGINEERING DATA

The KR s an open ge cre or os re ay wi h 5 or 10 amp on ac s n arrangements o 3PDT The KR is enc osed in c ear po ycarbona e dus cover The KRP wi h certain con ac arrangements is *UL recognized (see Ordering In* on page One and wo pole KRPs wi h ungrounded frame have con ac s ra ed for opposite po ari y three po e re ays are rated for same po ari y on y

Bo h KR anu KRP are rugged c s ruc ed to prov de ong opera ng fe and re iab ty Mechan cal tes s indica e a fe expectancy of more han 10 m ion operations The co s o bo h types are centr ucs v more ena ed for m proved mo sture res stance

A hold down spr ng can be furn shed for KRP re ays in app ca ons requ ring a her han spr ng moun ng or where v bra on is a prob em

Hermet ca sea ed mod s ar av ab e on special order

KRP INDICATOR LAMP RELAYS

The KRP s he KR re ay wi h an in ca or amp for ndica on of re ay ac on or fi h sh ng app c ons T amp gh s when he c is energ zed A st c c ion cuts off KRP re ays app y KR 's has s ver cadm um ox de con acts ra ed 10 amps n y n m s wi h 28 VDC coils

CONTACTS

Arrangements

AC and DC Form C (SPDT NO and Form C (3PDT

UL Rating

KR nor UL

S ver contacts codes G & L—3 con ac arrangemen s 5 amps @ 120V AC 3 amps @ 240 VAC 1 10 HP @ 120V AC 1/6 HP @ 240 V AC

S ver cadm um ox de con acts codes G & N—1 & 2 pole mod e s 10 amps @ 250V AC 1 6 HP @ 1.0V AC 1 3 HP @ 250V AC

3 po e models 10 amps @ 120V AC 6 amps @ 250V AC 1/6 HP @ 120V AC 1 3 HP @ 250V AC

Factory Rating (silver cadmium oxide)

KR and KRP 10 amps 120 V AC 80% P F 10 amps 28 V DC res s ve 6 amps 250 V AC 80 % P F Silver KR and KRP 5 amps 120 V AC 80% P F 5 amps 28 V DC resistive

CSA Rating Th KRP C one ad two pol mode s are CSA Cert fied for 3Tons po e s w h frame ne ec ed HP 120V AC 1 3 HP 250V AC and 10 amps 120 V AC Three pole mo e s are ra ed 5 amps pe con acts frame ground ed 1/6 HP 120 V AC 10 amps 120 V AC and 6 amps 240V AC

COILS

Voltage

KR 125 V DC or V AC 60 Hz
KRP 6 12 V DC or 265 V AC 50/60 Hz

Power

DC 1 wa s s andard 12 m W m n ner mov ab e arm
AC

Operate

AC 85% of nom na voltage @ 25°C
DC 75% or ess o nom na va ue @ 25°C

Time Values (approx.)

Operate 15 mi liseconds (does not inc ude bounce)
Re ease 10 mi l seconds (does not inc ude bounce)

Resistance See Co l Data Chart

Duty Continuous

GENERAL

Description Med um duty open or enc osed re ays

Insulation Material Lam na ed pheno ic

Initial Insulation Resistance 1000 megohms

Expected Life Mechanical 10 m l on opera ons minimum
E ec r ca 100 000 opera ons m nimum @ ra ed load

Initial Breakdown Voltage KRP C 1500 V rms between a e ements Al o her mode s 500 V rms between elements

Temperature Range

AC and DC 45° C minimum
AC 70° C max mum open re ays
DC +85° C max mum open relays
AC 55° C m x mum enc osed relays
DC +70° C maximum enclosed re ays

Weight Approx 1 7 ozs open approx 3 ozs enclosed

Enclosures

The dust covers of KRP and KRP N re ays are transparent high impact po ycarbonate des gnated type P cases Hermetically sea ed me a cases types K and D are *a so available*

COIL DATA FOR KR AND KR3-H SERIES RELAYS

DC			AC (50/60 Hz)		
Nominal Voltage	Resistance in Ohms +10% @ 25°C	Nominal Current Milliamperes	Nominal Voltage	Resistance in Ohms +15% @ 25°C	Nominal Current Milliamperes
6	32	188	6	80	335
12	120	100	12	24	168
24	472	51	24	85	84
48	1 800	26 6	120	2 250	17 5
110	10 000	11 5	240	9 110	8 75
220	Use 110 V re ays w h 10 000 ohm 5 W w re wound resistor in s ries				

Order ng nf rmat on on Nex Page

ORDERING INFORMATION

Sample Part No	KRPA	5	A	Y	12

BAS C SER ES = KRPA

CONTACT ARRANGEMENT

1 = 1 Form A (SPS" NO)	7 2 Form A (DPST NO)
2 = 1 Form B (SPST NC)	8 = 2 Form B (DPST NC)
3 = 1 Form X (SPST NO DM)	11 = 2 Form C (DPDT)
4 = 1 Form Y (SPST-NC DB)	12 = 3 Form A (3PST NO)
5 = 1 Form C (SPDT)	13 = 3 Form B (3PST NC)
6 = 1 Form Z (SPDT(DB DM))	14 = 3 Form C (3PDT)

COIL INPUT

A = AC 50 60 Hz
D = DC

CONTACT MATERIAL & INDICATOR LAMP OPTION

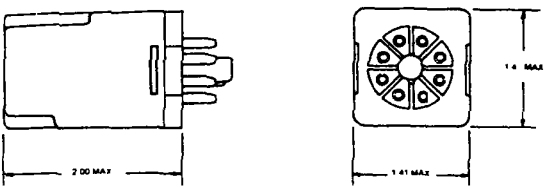
Y = S ver contacts no ind cator amb
G = S ver cadm um ox de contacts no nd cator amp
L = S ver contacts w th nd cator amp*
N = S ver cadmium ox de contacts w th ind cator amp*

COIL VOLTAGE

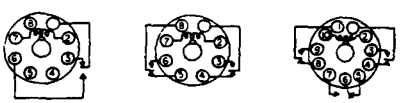
To 2"7 AC 50 60 Hz or 125V DC

nd cator amp s not ava ab e on mode s w th 25 90V co s Only
120 240\ AC and 110v DC mode s are UL recognized

OUTLINE DRAWINGS



WIRING DIAGRAMS



KRPA 5 KRPA 11 KRPA 14

Overview

This manual describes the 110/220 VAC Power Supply Module (shown in Figure 1) and gives instructions for installing it in an I/O base.

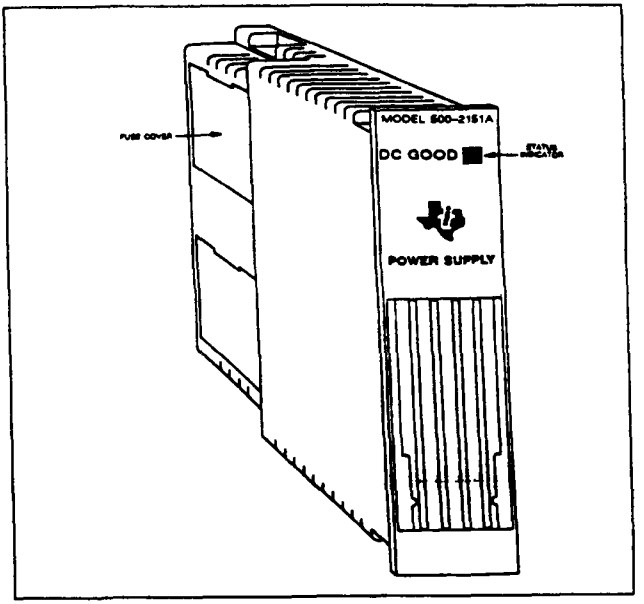


Figure-1 110/220 VAC Power Supply Module

Description of the Module

The 110/220 VAC Power Supply Module converts user-supplied AC power to DC power and operates within input voltage ranges of either 110 VAC or 220 VAC. The module supplies +5.1 and -5.0 VDC to the base.

Compatibility

The power supply module fits the Model 500-5840 Adapter Base, the Model 500-5848 14-Slot I/O Base, the Model 500-5884 12-Slot I/O Base, and the Model 500-5892 6-Slot I/O Base. It supplies power for the following controllers and modules.

- Model 520C, 530C or 530T Programmable Controller
- Model 500-2108 I/O Channel Controller (IOCC)
- Model 500-2109 Distributed Base Controller
- Model 500-2112 or 500-2114 Remote Base Controller
- Model 500-2161 6MT to Series 500 Base Controller
- I/O modules occupying the same base as the power supply

Input Overcurrent Protection

A 3 amp, 250 VAC slow blow fuse protects the input power source

Output Overcurrent Protection

The +5 1 and -5 0 V outputs are protected against overloads and short circuits A short circuit or overload of approximately 13 amps on the +5 1 V output causes both outputs to turn off To restore operation, remove input power, correct the overload condition, wait 30 seconds, and restore power A short circuit or overload of approximately 1 3 amps on the -5.0 output causes only the -5 0 V to drop out (The DC GOOD indicator goes out) Remove the overload or short circuit on -5.0 V to allow the supply to recover

Output Overvoltage Protection

The output loads are protected from overvoltage in the event of power supply component failure Should a failure occur, the supply latches off before either output reaches 6.4 V. If the overvoltage is externally induced, remove input power for 30 seconds to reset the supply Correct the condition causing excess voltage before restoring input power

---

NOTE: When an output overcurrent or overvoltage condition occurs, the power supply shuts down without giving warning to the rest of the system. The Model 520C, 530C, or 530T P/C reports a fatal error and program execution halts, controllers other than these three could drop off-line until the power supply recovers.

Status Indicator

An indicator on the front bezel lights when the module is producing DC power within specifications. The indicator goes out if AC input power is off, if current load exceeds 54 W of +5 1 V or 3 75 W of -5 0 V, or if output voltage exceeds 6 4 V

SERIES 500 SYSTEM OVERVIEW

1.1 INTRODUCTION

The 520C/530C/530T Programmable Controllers (P/Cs) and their support equipment are computer-controlled systems that are capable of managing the operation of other systems. These P/Cs execute the same functions as relays, static control, or card logic control systems They can detect the change in state of input signals from such devices as pushbuttons, limit switches, and sensors Acting on this information and executing a Relay Ladder Logic (RLL) program stored in memory, the 520C/530C/530T P/Cs produce output signals to drive motor starters, solenoids, and pilot lights, etc., that regulate the operation of various pieces of equipment

The 520C/530C/530T P/Cs differ from the 520/530 models primarily through the execution of a compiled RLL program, as opposed to using a separate Boolean processor and an interpreter The 530T is an enhanced version of the 530C that offers the following features

- The scan time for Boolean logic is reduced significantly (from 4 milliseconds per K words of memory to 0 9 milliseconds per K words of RLL memory).
- The communication ports support baud rates up to 19,200 baud, providing faster communication with the Video Programming Unit (VPU) and other operator interfaces.
- The RLL program can be downloaded to an Electrically Erasable Programmable Read Only Memory (EEPROM).

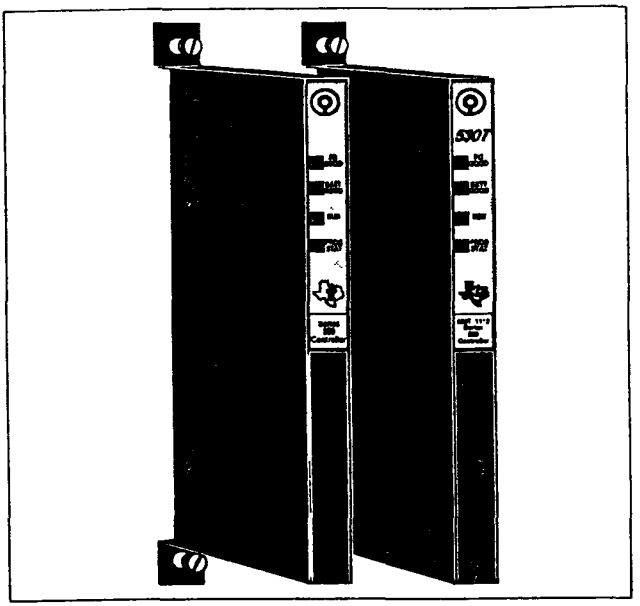


Figure 1-1 The 520C/530C and 530T Programmable Controllers

The Series 500 product line is designed for use in small to medium applications such as discrete, word, and analog control. Components include the 520C/530C/530T P/Cs, shown in Figure 1-1, and the support devices that provide operator communication, I/O control, and power

I/O control for the Series 500 system takes place through individual Series 500 I/O modules. A full line of discrete, analog, and word I/O modules are available that can handle almost any input or output specifications. These I/O modules are rugged, plug-in devices capable of functioning in harsh environments.

I/O modules are grouped into local and distributed I/O categories. The local I/O consists of those modules installed in the same base assembly as the P/C. The 520C model can support up to 512 local I/O points. You can create a distributed I/O system for all other models by connecting up to 14 additional base assemblies. The 530C-1104, -1108, -1112, and 530T-1104 and -1112 P/Cs support up to 1023 I/O points in a system with both local and distributed bases.

When additional bases are connected to the system, distributed I/O is managed through communication between base controllers — the I/O Channel Controller (IOCC) and one or more Distributed Base Controllers (DBC). The 500-2109 (or earlier model 500-2103) DBC in each distributed base assembly transmits data from the I/O modules in that base assembly to the 500-2108 IOCC, which occupies the same base assembly as the P/C. Your 530C/530T P/C can address distributed bases up to 1300 feet (396 m) away.

Figure 1-2 shows the functional relationship of the 520C/530C/530T system components.

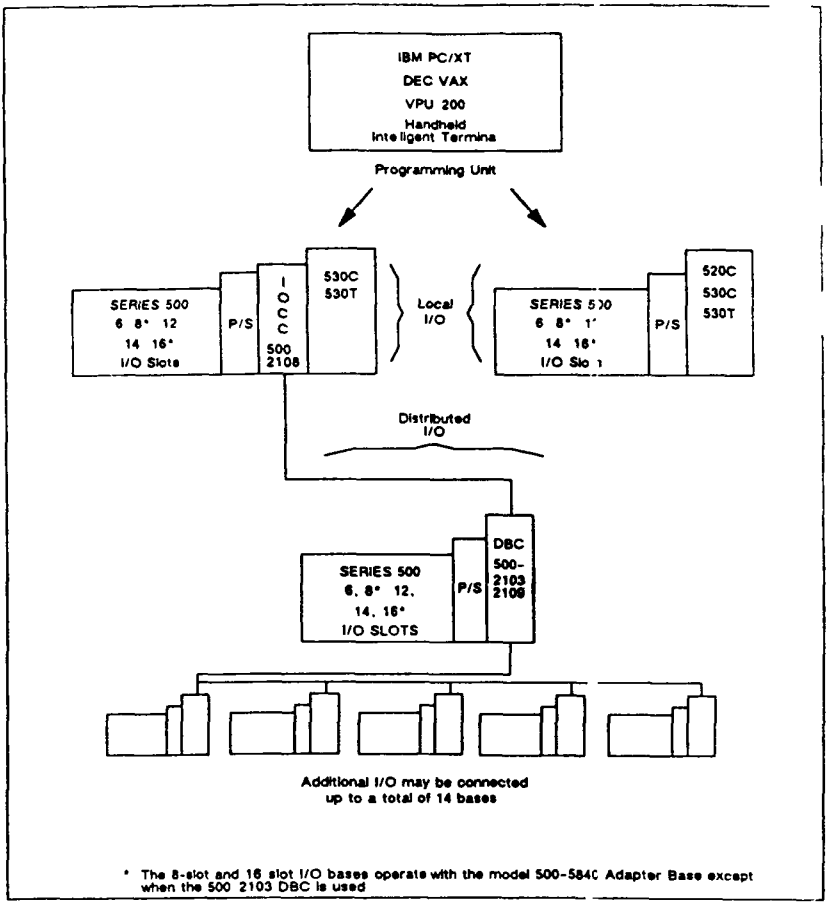


Figure 1-2 520C/530C/530T System Components

1.2.1 Program Software

The 520C/530C/530T P/Cs are programmed in standard relay ladder logic, and Texas Instruments TISOFT programming software provides a means of entering, debugging, and documenting your RLL program TISOFT is menu-driven, provides both RLL and advanced program special functions language, and permits you to add comments to instructions Different versions of TISOFT are available TISOFT1 operates on the VPU, TISOFT2 is executed on an IBM PC/XT, and TISOFT3 runs in an off-line mode on a DEC VAX computer

You may also fully program the 520C/530C/530T in Boolean symbolic code using the Texas Instruments Handheld Intelligent Terminal

In addition to the standard relay ladder logic, the 520C/530C/530T programming instruction set offers more than 30 high-level, user-oriented operations The box instructions replace programming steps that once required hundreds of words of memory. More importantly, these instructions permit you to use the power of the P/C to perform complex functions, making program development and debugging faster and easier.

1.2.2 Program Storage in EPROM/EEPROM

The 520C/530C P/Cs offer the option of saving your RLL program in a non-volatile form by downloading it to an Erasable Programmable Read Only Memory integrated circuit A separate programming device s not necessary Once programmed, an EPROM may be removed and used in any of the 520C/530C models, provided the program is compatible with the system's capabilities. The 530T and the Series 505 Model 525/535 P/Cs can read information in the EPROM, but do not write data to it.

To ensure equipment compatibility use only the EPROM model supplied by your distributor (TI Part # 2587681-8012).

An Electrically Erasable Programmable Read Only Memory (EEPROM, TI Part # 2587681-8020) is used with the 530T Like the EPROM, the EEPROM can also be removed and used in other model 530T or 525/535 P/Cs The EEPROM cannot be used in the 520C/530C

1.2.3 Communication Ports

Each 520C/530C/530T P/C has a 25-pin RS-232-C/RS-423 compatible port configured as Data Terminal Equipment (DTE) This port may be used for communicating with programming equipment such as the Timer/Counter Access Module (TCAM), the VPU, or a modem up to 50 feett (15 m) away.

An RS-422 compatible port is also available on the 520C/530C/530T P/Cs This port may be used for communicating with a CVU or a modem and allows communication to a distance up to 1000 feet (305 m) at all baud rates supported by the P/C model

Mount the 520C/530C/530T components in a dustproof and drip tight enclosure such as the NEMA Type 12 enclosure The enclosure must provide a minimum depth of 25 4 cm (10 in) from the panel to the inside surface of the enclosure door The enclosure should be located so that the doors may be opened fully, permitting easy access to the P/C, wiring, and components If environmental conditions permit, a 19-inch rack may be used instead of a NEMA enclosure Use the 12-slot Model 500-5884 I/O base for 19-inch rack installations

GROUNDING AND WIRING THE EQUIPMENT

A good grounding system is essential for proper operation of a 520C/530C/530T system and should be one of the most important considerations in planning your installation The structural ground present in many industrial environments does not provide an adequate ground return where direct wire connection is not feasible Appendix B is a discussion of grounding, electromagnetic interference (EMI), and other electrical considerations See the guidelines in *Appendix B to be certain to meet all grounding and wiring requirements*

TEMPERATURE CONSIDERATIONS

When preparing your installation, plan for an adequate air flow to ensure proper cooling of equipment Do not permit the convective cooling of the P/C to be hindered Mount the P/C in an upright position so that cooling vents are at the top and bottom of the device rather than on the sides This permits maximum convective air flow around the module heat sinks

House the P/Cs in a cabinet having enough clearance to prevent the accumulation of hot air. Unless ambient temperatures are extremely high, a fan or air-conditioned cooling is unnecessary for keeping 520C/530C/530T P/Cs below their maximum-rated operating temperature of 60°C

00 00 34 04 11 07

INSTALLATION

3.1 INSTALLING THE BASE ASSEMBLIES

The P/C, I/O controllers, power supply, and I/O modules are mounted in Series 500 base assemblies. Three Series 500 base assembly models are designed specifically for the 520C/530C/530T P/Cs.

- Model 500-5892, 6 I/O slots
- Model 500-5884, 12 I/O slots (19-inch rack compatible)
- Model 500-5848, 14 I/O slots

Each base has a "controller slot" which holds the P/C or a DBC, and two slots, A and B, that are used by the power supply and/or an IOCC. See Figure 3-1.

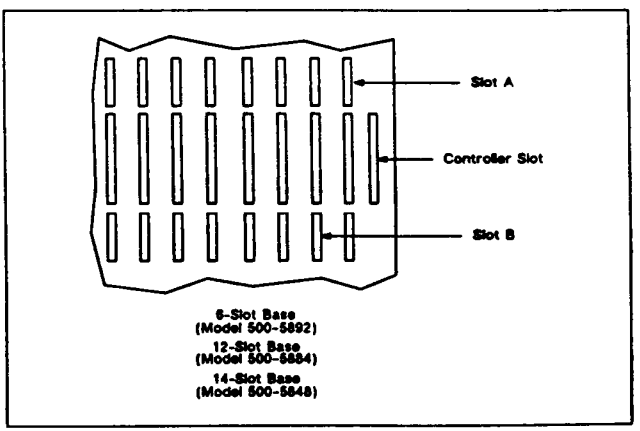


Figure 3-1 Base Assembly Controller and Power Supply Slots

The earlier models 16-slot Model 500-5828 base and 8-slot Model 500-5864 bases may also be used with the 520C/530C/530T P/Cs However, they operate in conjunction with the Model 500 5840 Adapter Base The adapter base contains the "controller slot" and slots A and B The adapter base is inserted into the side of the 500-5828 or the 500-5864 base as shown in Figure 3-2

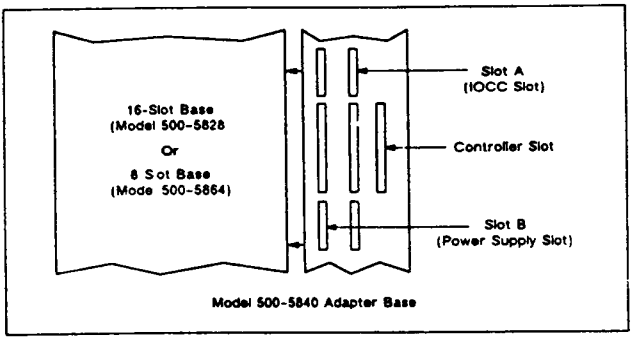


Figure 3-2 Adapter Base Controller and Power Supply Slots

Only the Model 500-5884 12-slot base may be used for a rack installation However, all bases may be panel mounted If the Model 500-5840 Adapter Base is used, it must be mounted immediately adjacent and to the right of a 500-5828 or a 500-5864 base assembly. Be sure to allow sufficient space for it.

Installation instructions for the Series 500 I/O bases are given in the *Series 500 I/O Bases User's Manual* (500-8140).

3.2 HANDLING SERIES 500 MODULES

Many integrated circuit (IC) devices are susceptible to damage by the discharge of static electricity Follow the suggestions listed below to reduce the probability of damage to these devices when you are handling a P/C, an I/O controller, or any of the I/O modules **To minimize risk of shock hazard, make certain power to the P/C system is turned off.**

Both the module and the person handling the module should be at the same ground potential To accomplish this, ensure that

- The module is transported in an antistat c container or antistatic material
- The work area has a conductive pad with a lead connecting it to a common ground.
- You are grounded by making contact with the conductive pad and/or by wearing a grounded wrist strap

The following precautions, although less effect ve, may be taken to minimize the possibility of component damage resulting from electrostatic discharge·

- To discharge static electricity, touch a grounded piece of metal before touching the circuit board or any of its components
- Wear non-synthetic clothing
- Handle all modules by the external casing, and avoid contact with the circuit board or any of its components.

3.3 SETTING 520C/530C DIPSWITCHES

A block of ten dipswitches is located inside the battery door of the 520C/530C Refer to Figure 3-3 These switches are used to set operation parameters for the P/C An individual switch is OFF when pushed all the way to the right, and is ON when pushed to the left, toward the switch numbers

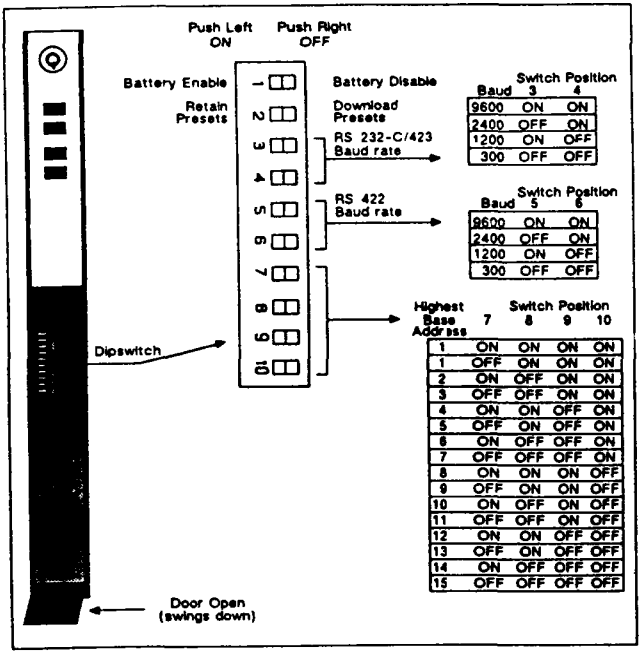


Figure 3-3 *Location of the Dipswitch for the 520C/530C Models*

3.3.1 Selecting Battery Backup — 520C/530C Models

Switch 1 on the dipswitch assembly enables or disables the battery backup function. With the battery backup enabled, cycling power does not alter the following information:

- RLL program
- Timer/counter preset and current values
- Drum preset and current values
- Word I/O values
- Variable (V) memory values
- Retentive control relay status
- States of forced I/O
- Scan time
- I/O Configuration data

If you power up a 520C/530C without a good battery installed or with the battery backup dipswitch turned OFF and you have not installed an EPROM, the P/C clears memory.

If you are powering up a 520C/530C for the first time, disable the battery backup and do not install a programmed EPROM. This ensures that the P/C is properly initialized by clearing all system memory.

Refer to Figure 3-4. Turn switch 1 ON to enable the battery backup. Turn switch 1 OFF to disable battery backup.

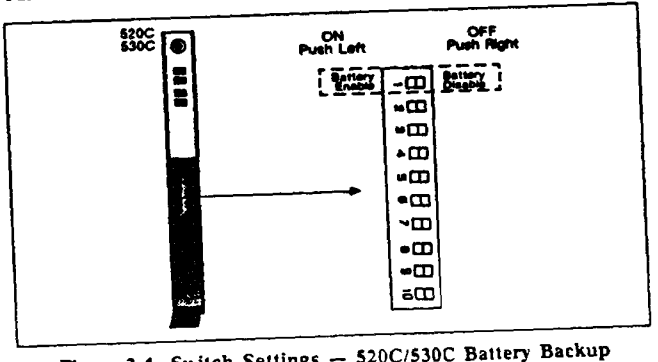


Figure 3-4 Switch Settings — 520C/530C Battery Backup

3.3.2 Downloading Preset Constants — 520C/530C Models

The drum and timer/counter instructions have reserved sections of memory where preset variables are stored These variables may be changed with an operator interface, such as a TCAM or VPU, or with an RLL instruction, without altering their value in RLL memory If you cycle power or execute AUX Function 10 while the battery is enabled, switch 2 on the dipswitch determines whether the changed values in preset memory are retained or the original values are downloaded from RLL memory If the battery is dead, low, or disabled, the preset values are always downloaded from the RLL program in an EPROM, if one is installed

Refer to Figure 3-5. Turn switch 2 ON to have preset values retained Turn switch 2 OFF to have preset values downloaded from the RLL program

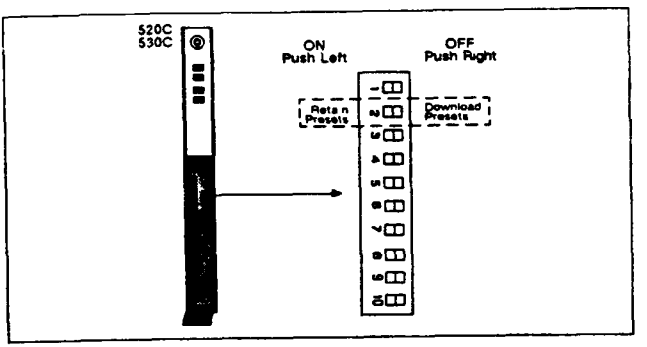


Figure 3-5 Switch Settings — 520C/530C Download/Retain Presets

NOTE

Executing AUX Function 12 (P/C Complete Restart) with your programming device causes the presets to be downloaded from the RLL program, regardless of the state of this dipswitch

3.3.3 Setting Port Baud Rate — 520C/530C Models

Figure 3-6 shows the baud rate switch assignments for the communication ports. Switches 3 and 4 on the dipswitch set the baud rate for the RS-232-C/423 25-pin port (Port 1). Switches 5 and 6 set the baud rate for the RS-422 9-pin port (Port 2). Switch position does not matter if a device is not to be connected to the port.

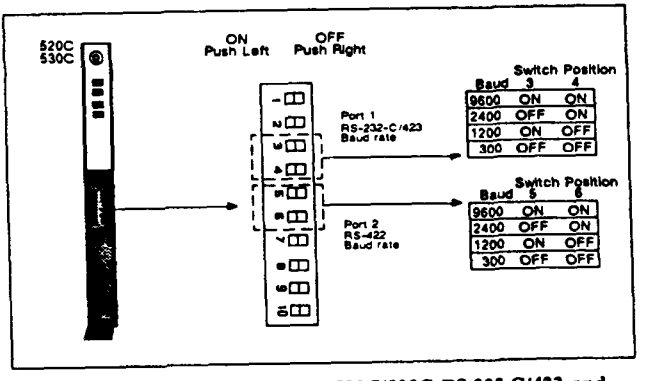


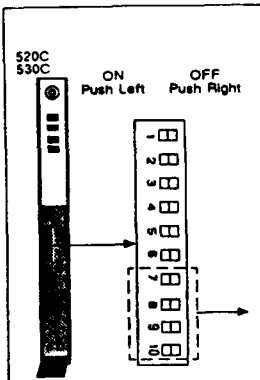
Figure 3-6 Switch Settings — 520C/530C RS-232-C/423 and RS-422 Ports

3.3.4 Setting Highest I/O Base Number — 530C Models

The base assembly holding the P/C also holds the local I/O The local I/O consists of the first two logical bases, numbered 0 and 1 A logical base is defined as a group of eight I/O slots As many as fourteen additional logical bases, numbered from 2 to 15, may be connected to the system as distributed I/O

Switches 7–10 on the dipswitch are used to select the highest-numbered logical base in the system For example, if your system consists of 5 logical bases numbered 0 through 5, then the dipswitches should be set for 5 Refer to Figure 3-7.

Switches 7–10 can reduce I/O update time by preventing the P/C from attempting to communicate with distributed bases that are not present or which you may have shut down Although it increases scan time, you can set the switches for 15 if you prefer, regardless of the actual number of logical bases that are connected



Highest Address	Switch Position 7	8	9	10
1	ON	ON	ON	ON
1	OFF	ON	ON	ON
2	ON	OFF	ON	ON
3	OFF	OFF	ON	ON
4	ON	ON	OFF	ON
5	OFF	ON	OFF	ON
6	ON	OFF	OFF	ON
7	OFF	OFF	OFF	ON
8	ON	ON	ON	OFF
9	OFF	ON	ON	OFF
10	ON	OFF	ON	OFF
11	OFF	OFF	ON	OFF
12	ON	ON	OFF	OFF
13	OFF	ON	OFF	OFF
14	ON	OFF	OFF	OFF
15	OFF	OFF	OFF	OFF

Figure 3-7 Switch Settings — 520C/530C Highest-Numbered Logical Base

3.4 SETTING 530T DIPSWITCHES

A block of twelve dipswitches is located inside the battery door of the 530T Refer to Figure 3-8 These switches are used to set operation parameters for the P/C An individual switch is OFF when pushed all the way to the right, and is ON when pushed to the left, towards the switch numbers

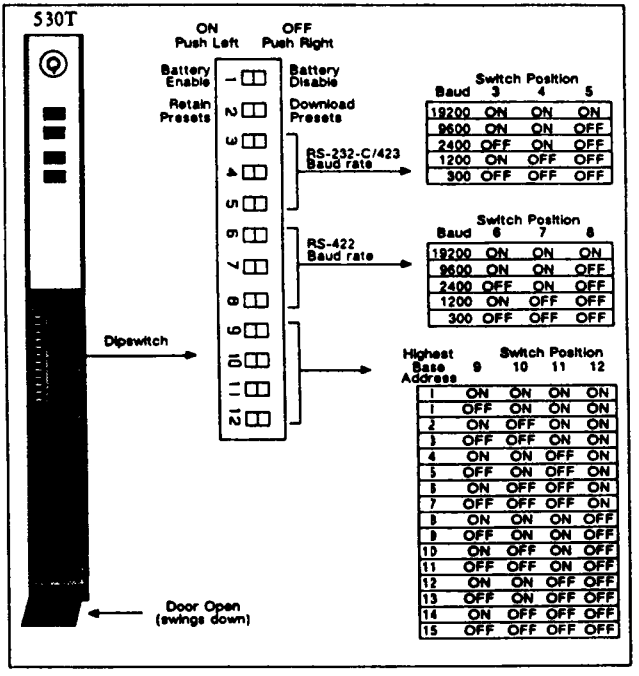


Figure 3-8 Location of the Dipswitch for the 530T Models

3.4.1 Selecting Battery Backup — 530T

Switch 1 on the dipswitch assembly enables or disables the battery backup function. With the battery backup enabled, cycling power does not alter the following information:

- RLL program
- Timer/counter preset and current values
- Drum preset and current values
- Word I/O values
- Variable (V) memory values
- Retentive control relay status
- States of forced I/O
- Scan time
- I/O Configuration data

If you power up a 530T with the battery backup dipswitch turned OFF and you have not installed an EPROM/EEPROM, the P/C clears memory.

Refer to Figure 3-9 Turn switch 1 ON in order to enable the battery backup Turn switch 1 OFF to disable battery backup

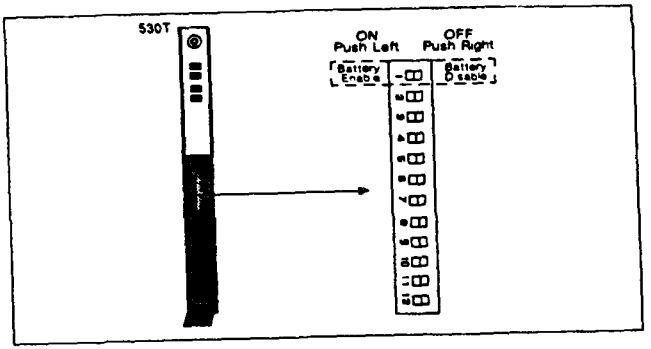


Figure 3-9 Switch Settings — 530T Battery Backup

NOTE

If you are powering up a 530T for the first time, turn off the battery backup and do not install a programmed EPROM/EEPROM This ensures that the P/C is properly initialized.

3.4.2 Downloading Preset Constants — 530T Models

The drum and timer/counter instructions have reserved sections of memory where preset variables are stored. These variables may be changed with an operator interface, such as a TCAM or VPU, or with an RLL instruction, without altering their value in the RLL program. If you cycle power or execute AUX Function 10 while the battery is enabled, switch 2 on the dipswitch determines whether the changed values in preset memory are retained or the original values are downloaded from the RLL program. If the battery is dead, low, or disabled, the preset values are always downloaded from the RLL program in an EPROM, if one is installed.

Turn switch 2 ON to have preset values retained. See Figure 3-10. Turn switch 2 OFF to have preset values downloaded from the RLL program.

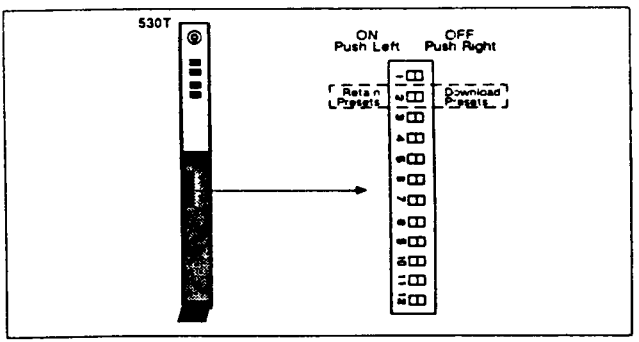


Figure 3-10 Switch Settings — 530T Download/Retain Presets

NOTE

Executing AUX Function 12 (P/C Complete Restart) with your programming device causes the presets to be downloaded from the RLL program, regardless of the position of dipswitch 2.

3.4.3 Setting Port Baud Rate — 530T Models

Figure 3-11 shows the baud rate switch assignments for the communication ports. Switches 3–5 on the dipswitch set the baud rate for the RS-232-C/423 25-pin port (Port 1). Switches 6–8 set the baud rate for the RS-422 9-pin port (Port 2). Switch position does not matter if a device is not to be connected to the port.

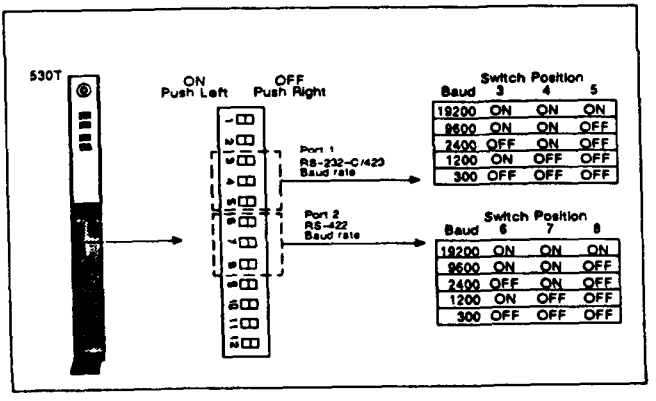


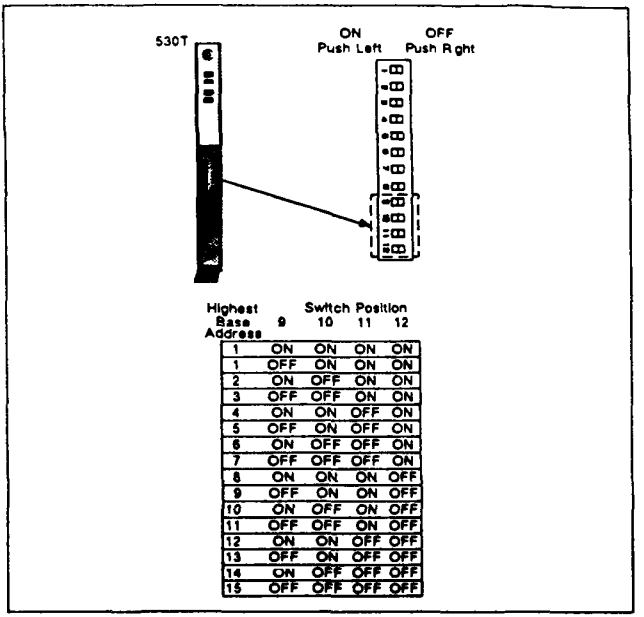
Figure 3-11 Switch Settings — 530T RS-232-C/RS-423 and RS-422 Ports

3.4.4 Setting Highest I/O Base Number — 530T Models

The base assembly holding the P/C also holds the local I/O The ·ocal I/O consists of the first two logical bases, numbered 0 and 1 A logical base is defined as a group of eight I/O slots As many as fourteen additional logical bases, numbered from 2 to 15, may be connected to the system as distributed I/O

Switches 9–12 on the dipswitch assembly are used to select the highest-numbered logical base in the system For example, if your system consists of 5 logical bases numbered 0 through 5, then the dipswitches should be set for 5 Refer to Figure 3-12

Switches 9–12 can reduce I/O update time by preventing the P/C from attempting to communicate with distributed bases that are not present or which you may have shut down Although it increases scan time, you can set the switches for 15 if you prefer, regardless of the actual number of logical bases that are connected



Highest Base Address	Switch Position 9	10	11	12
1	ON	ON	ON	ON
1	OFF	ON	ON	ON
2	ON	OFF	ON	ON
3	OFF	OFF	ON	ON
4	ON	ON	OFF	ON
5	OFF	ON	OFF	ON
6	ON	OFF	OFF	ON
7	OFF	OFF	OFF	ON
8	ON	ON	ON	OFF
9	OFF	ON	ON	OFF
10	ON	OFF	ON	OFF
11	OFF	OFF	ON	OFF
12	ON	ON	OFF	OFF
13	OFF	ON	OFF	OFF
14	ON	OFF	OFF	OFF
15	OFF	OFF	OFF	OFF

Figure 3-12 Switch Settings — 530T Highest-Numbered Logical Base

3.5 INSTALLING THE BATTERY

The 520C/530C/530T P/Cs are shipped with a lithium battery already installed This battery has a minimum storage lifetime of three years and a minimum backup lifetime of six months (0° to 60°C)

If you are powering up a P/C for the first time, disable the battery backup and do not install a programmed EPROM/EEPROM to make certain that all P/C memory is properly initialized

Refer to Figure 3-13 and follow the steps listed below to replace the battery

1 Ensure that the power to the P/C is on Replacing the battery with power off may result in memory loss

2 Open the battery door This is most easily done by inserting a flat-blade screwdriver into the slot above the door Pull gently on the middle of the door while turning the screwdriver

3 Disable the battery by setting Switch 1 to the OFF position.

4 Remove the battery from the clip and disconnect the leads

5 The new battery must be a 3 0 VDC UL recognized lithium battery (TI part # 2587678–8005) Connect the red wire to the positive pole and the black wire to the negative pole of the new battery Insert the new battery into the battery clip.

6. Set the battery dipswitch ON and verify that the BATT GOOD LED comes on

7. Close the battery door

WARNING

If the P/C is powered down with the battery off or disconnected, or if a battery is replaced with P/C power off, do not power up the P/C with the battery enabled. Memory may be affected, resulting in random outputs, and possible injury to personnel and damage to equipment.

3.6 INSTALLING SYSTEM COMPONENTS

The following paragraphs describe local and distributed I/O, the numbering of I/O points, and the installation procedures for modules

3.6.1 Installing Local vs. Local/Distributed I/O Systems

A base assembly is composed of one or two logical bases A logical base is defined as a group of eight I/O slots, as shown in Figure 3-14 The Model 500-5828 16-slot base assembly comprises two logical bases. The Model 500-5848 14-slot base also contains two logical bases, but slots 7-8 on the second base do not physically exist A system may consist of as many as 16 logical bases and up to 1023 I/O points

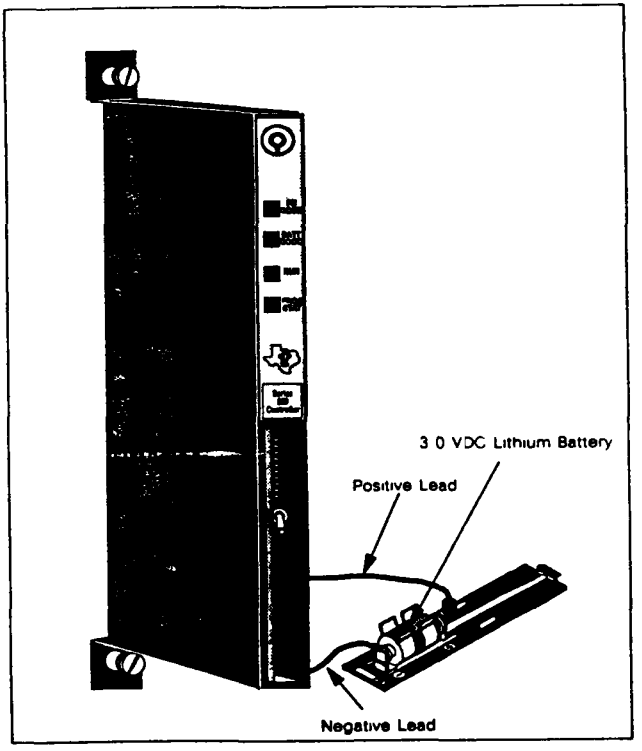


Figure 3-13 Location of Battery

If you are restarting your system always make sure that there is a good battery installed. If the battery is not in place upon power-up, and no EPROM/EEPROM is installed, the system memory is cleared. The same holds true if you power up with a dead battery or with the battery dipswitch (switch 1) turned OFF.

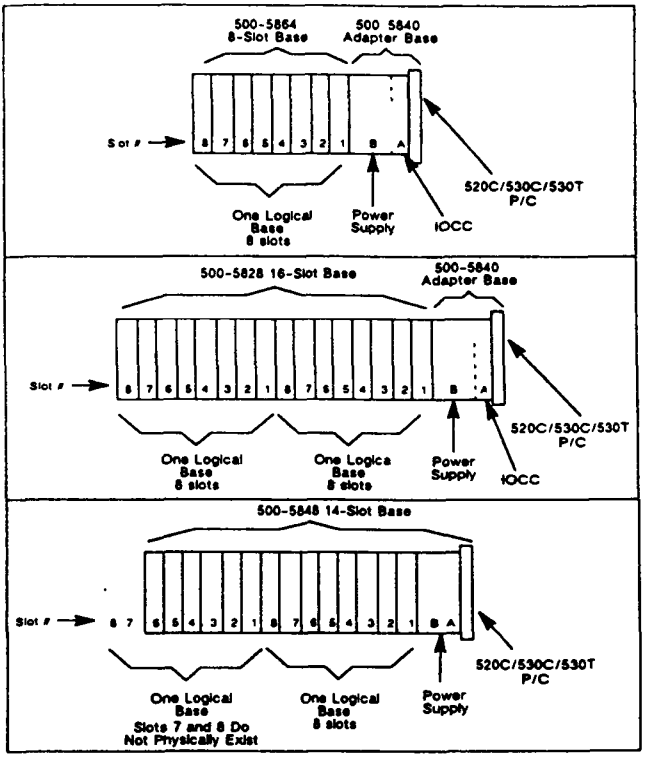


Figure 3-14 Definition of the Series 500 Logical Base

I/O modules are grouped into local or distributed I/O categories depending upon their physical location The local I/O comprises those modules installed in the same base assembly as the P/C — the primary base

A system having local I/O only consists of a single base assembly compr sing a maximum of two logical bases. The 16-slot, 14-slot, and 12-slot base assemblies contain two logical bases, numbered 0 and 1 from right to left The 8-slot and 6-slot base assemblies each contain one logical base, numbered 0 See Figure 3-15

If your system has local I/O only, you need to install the power supply, P/C and I/O modules in a single base assembly. See the installation instructions later in this chapter

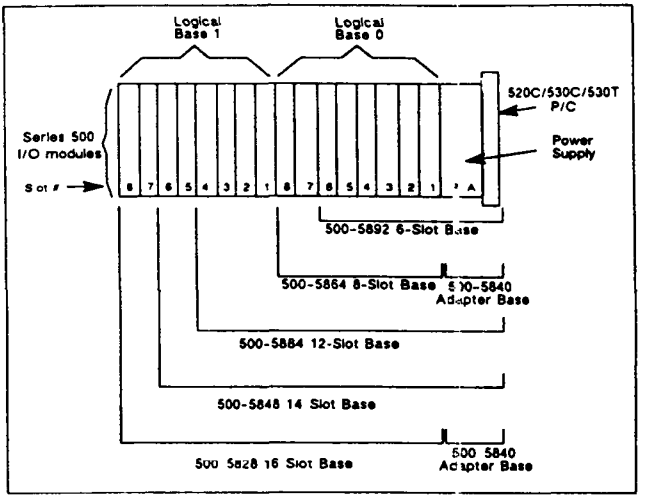


Figure 3-15 System With Local I/O Only

With the exception of the 520C, you can connect up to 14 additional base assemblies to your system as shown in Figure 3-16 The 520C does not support distributed I/O These additional bases constitute the distributed I/O and are numbered from 2 to 15

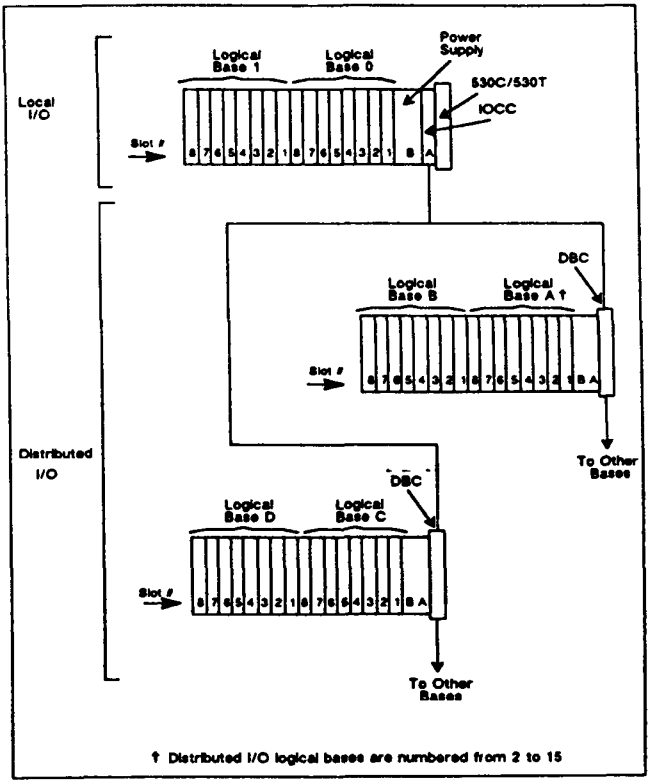


Figure 3-16 Systems with Local and Distributed I/O

The I/O modules in the distributed bases communicate with the P/C through base controllers The Model 500-2109 or -2103 Distributed Base Controller (DBC) in each distributed base assembly transmits all information from the I/O modules in that base assembly to the Model 500-2108 I/O Channel Controller (IOCC)

A system with distributed I/O requires one IOCC, installed adjacent to the P/C in the primary base Depending upon the cable used, the line drivers of the DBC and the IOCC permit distr buted I/O to be up to 1300 feet (396 m) from the P/C You must also install the distributed bases with their power supplies, DBCs, I/O modules, and cabling See the installation instructions later in this chapter

3.6.2 Numbering Series 500 I/O Points

When you configure the I/O, you must assign the I/O point numbers yourself if you intend to use any modules having more than eight I/O points per physical I/O slot You do this from the I/O Module Definition Chart on your programming device

Local I/O consisting of a maximum of 512* I/O points can be configured when you assign the I/O point numbers This is obtained by using base Model 500-5828 (16 slots) with the 500-5840 adapter base and 32-point I/O modules

The P/C permits a maximum number of 1023 points for a local and distributed system You need not assign the point numbers consecutively For example, in a distributed system, Base 2 can be assigned I/O point numbers 897-960 However, the highest point number that you can assign to a point is 1023.

You do not need to assign I/O point numbers to the non-existent slots in logical bases having fewer than eight slots.

Unless you configure the I/O, the Series 500 P/C automatically logs in all eight-point modules Modules having greater than eight points are not logged in, however, their presence in the I/O base is indicated when you execute a Read Base function with your programming unit You cannot use that module until you have entered it into the I/O configuration

* I/O module power consumption requirements may reduce the actual number of I/O points that can be installed

When the P/C logs in the modules and configures the I/O automatically, the eight-point module addresses are assigned numbers according to the slot and the base in which the module is located. A maximum of 128 points is available for local I/O when the P/C assigns slot numbers.

The point number assignments can be determined by referring to Figure 3-17. You can calculate the module starting number by using the following equation:

$$\text{Starting Number} = 1 + [(\text{Logical Base \#}) \times (64) + (\text{Slot \#} - 1) \times 8]$$

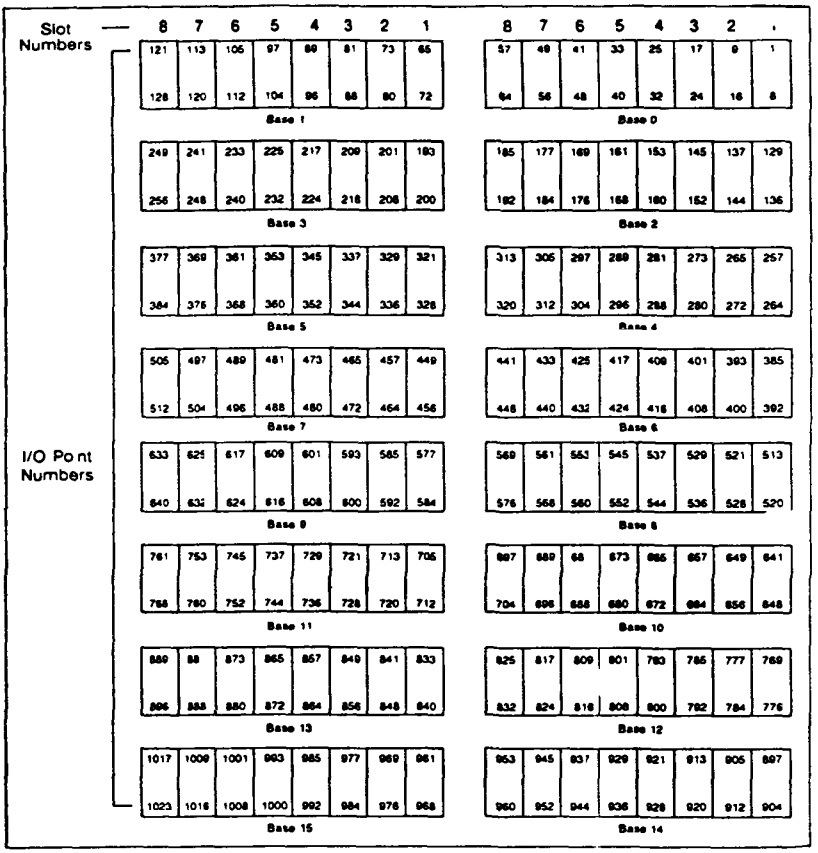


Figure 3-17 Series 500 I/O Point Automatic Numbering

The 6-, 12-, and 14-slot I/O base assemblies hold one logical base that has fewer than 8 slots Because the default numbering is configured on multiples of the 8-slot logical base, I/O point numbers are assigned to points on nonexistent slots For example, in the Model 500-5848 14-slot base assembly, I/O points 113-128 are assigned to the two nonexistent slots on the second logical base of this assembly See Figure 3-18

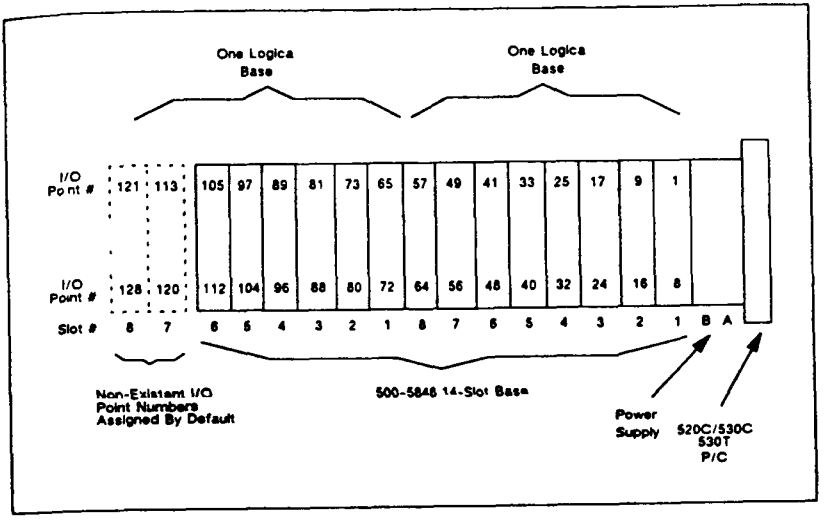


Figure 3-18 Default I/O Point Numbers for 14-Slot Base

NOTE

If you use the 6- 12- or 14-slot base for the P/C and install an IOCC as well, the power supply must be installed in Slot B, and I/O slot 1 will not be available This slot is covered by the power supply in this situation and cannot accommodate an I/O module. The I/O point numbers assigned this slot by the default numbering cannot be used

WARNING

Before inserting or removing the P/C or I/O modules, disable power to the system. Modules might be damaged or memory may be lost if modules are inserted or removed while power is on.

3.6.3 Installing the P/C

1. Check dipswitches for correct configurat on.
2. ***Disable all user-supplied power to the base.***
3. Remove the shunting bar that covers the edge card. Insert the P/C into the controller slot as shown in Figure 3-19 Tighten the two screws securely at the top and bottom of the P/C to secure the P/C to the base assembly and to ensure a proper ground

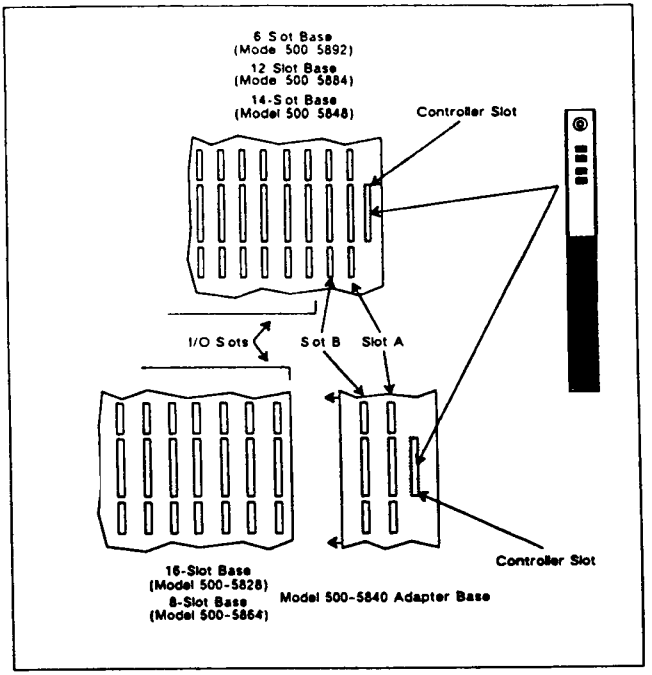


Figure 3-19 Location of the P/C on the Base Assemblies

CAUTION

If you intend to move or ship a P/C containing an RLL program that is backed up with the battery, do not install the edge card shunting bar. The battery will discharge through the shunting bar, and the RLL program may be lost or altered as a result.

4. If you have equipment to connect to the ports, attach the communication cables to the appropriate port(s) Both ports are located on the bottom of the P/C as shown in Figure 3-20

   The RS-232-C/RS-423 compatible port accepts a 25-pin male plug and allows communication with equipment up to 50 ft (15 2 m) The RS-422 compatible port accepts a 9-pin male plug and allows communication up to a distance of 1000 ft (305 m) for all baud rates supported by the P/C model. Both ports are configured as Data Terminal Equipment (DTE). The pin-outs are listed in Table 3-1

5 Enable power

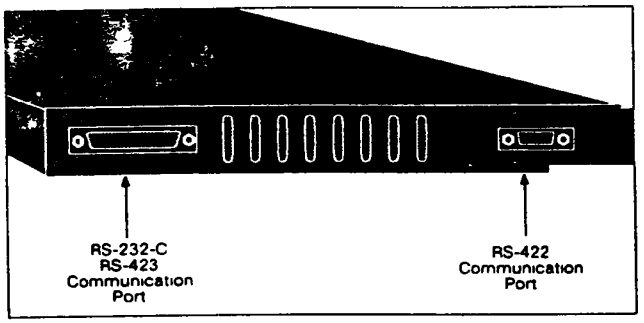


Figure 3-20 Location of the Communication Ports

Table 3-1 Pin-out for the Communication Ports

RS-232-C/RS-423 Port		RS-422 Port	
Pin	Signal	Pin	Signal
2	Transmitted data	1	Data out
3	Received data	5	Data in
4	Request to send	6	Ground
5	Clear to send	7	Data out, inverted
6	Data set ready	8	Data in, inverted
7	Signal ground		
8	Received line signal detector		
20	Data terminal ready		
	All others—no connection		All others—no connection

3.6.4 Installing the Power Supply

For detailed instruction on power supply installation, see the installation instructions in the user's manual for your particular model of power supply.

Unless you intend to install an IOCC in the same base as the power supply, always insert the power supply into slot A of base assembly Models 500-5892, -5884, and -5848. Refer to Figure 3-21.

If you intend to install an IOCC in the same base as the power supply, insert the power supply into slot B of base assembly Models 500-5892, -5884, and -5848 Because it is a double-wide module, the power supply also covers I/O slot 1 of base 0

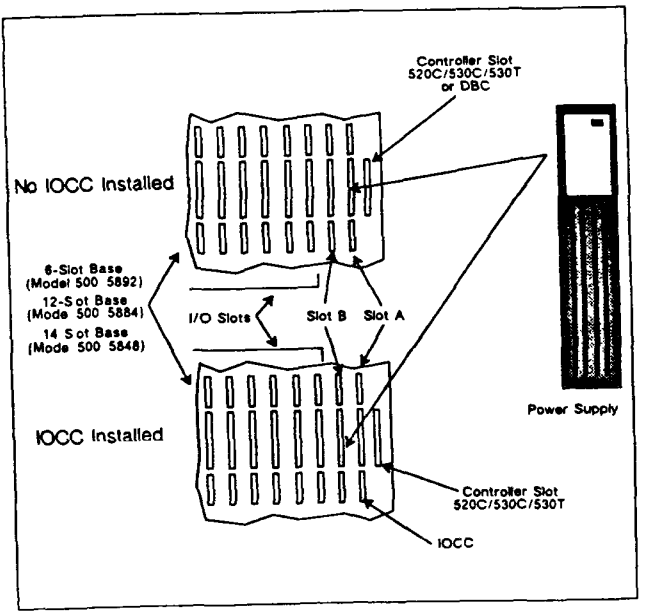


Figure 3-21 Location of Power Supply on Model 500-5892, 500-5884, and 500-5848 Base Assemblies

When using the model 500-5840 Adapter Base, insert the power supply into slot B of the adapter base, since slot A of the adapter base is reserved for an IOCC Refer to Figure 3-22 When used with the adapter base, the power supply module does not cover I/O slot 1 of base 0.

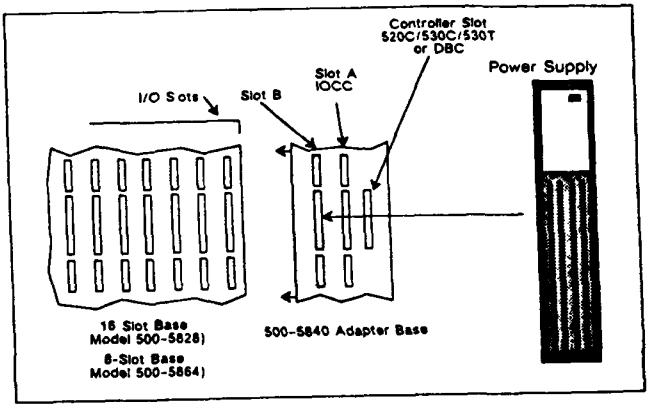


Figure 3-22 Power Supply Location on the Model 500-5840 Base Adapter

The base power budget must be determined from the power provided by the base power supply and the requirements of the modules being used When determining the I/O system layout, take care not to exceed the maximum secondary power available from the power supply.

The total power requirement for all modules drawing power from a base must not consume more power than the following power supplies can provide.

Model	+5 VDC	-5 VDC
500-2151	54 W	3 75 W
500-2151A	54 W	3 75 W
500-2153	56 W	3 75 W

3.6.5 Installing the I/O Modules

Insert the I/O modules into the I/O slots of the base, shown in Figure 3-23 Because the wiring for the different I/O modules may vary, read the user's manual for an individual module before wiring the base or the module

CAUTION

Use supply wires suitable for at least 75° C. Signal wiring connected in this box must be rated at least 300V.

ATTENTION

Employer des fils d'alimentation pour au moins 75° C. Le cablage de signalisation raccorde dans cette boite doit convenir pour une tension nominale d'au moins 300V.

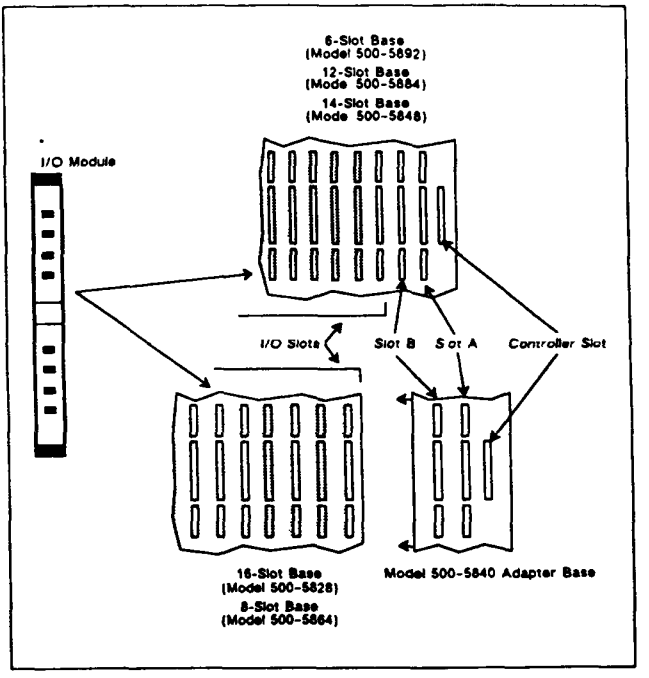


Figure 3-23 Location of the I/O Modules on the Base Assemblies

WARNING

Disable all power to the system before installing or removing I/O modules Failure to do so could cause damage to equipment or injury to personnel.

1 Disable power to the base and any modules in the base before inserting or removing a module

2 Remove the plastic static guard from the edge connector on the back of the module

3 Ensure that the slot is keyed correctly for the module being inserted

4 Carefully push the module into the selected slot Apply sufficient force to the module to engage the locking tabs on the I/O base One way to do this is to strike each end of the module with the palm of your hand to make certain the module is seated firmly

CAUTION

Do not pull the locking tabs toward the module in an effort to lock the module in the base. This could break the tabs.

5 After the locking tabs have secured the module, pull on the module (not the locking tabs) to ensure that the module is seated securely

INSTALLING THE EPROM/EEPROM

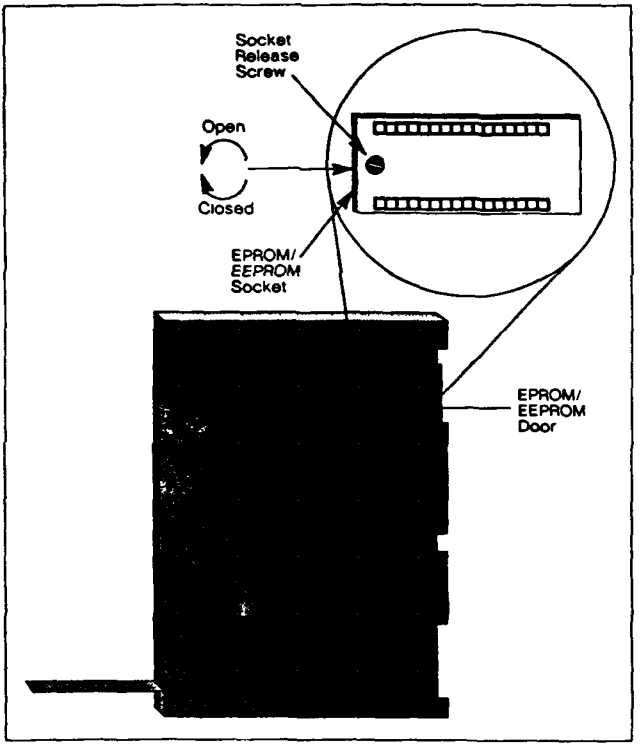
Before beginning installation, you must disable power to the P/C. If you intend to download a program in RAM memory to an EPROM/EEPROM, you should ensure that a good battery is installed and enabled, or the program may be lost when power is restored. Follow the steps listed below.

NOTE

If you are powering up a P/C for the first time, disable the battery backup and do not install a programmed EPROM/EEPROM. This ensures that the P/C is properly initialized.

1. Place the P/C in PROGRAM MODE.
2. Ensure that the Battery Good LED is on. If it is not, turn on switch 1 on the dipswitch assembly. This enables battery backup. If the Battery Good LED remains off, replace the battery before continuing with the EPROM/EEPROM installation.
3. **Turn off all user-supplied power to the P/C base.**
4. **Remove the P/C from the base assembly.**

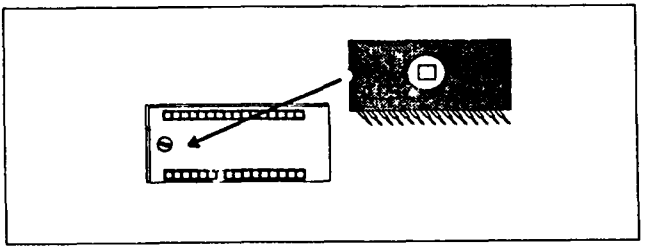
5 The door on the right side of the P/C, shown in Figure, allows access to the EPROM/EEPROM socket Open the door and locate the socket



Location of EPROM/EEPROM Socket

6 The EPROM/EEPROM socket is a zero insertion force socket, and no pressure is required to insert the 28-pin EPROM/EEPROM. Use a small, flat-blade screwdriver to open the socket. Turn the screw on the socket counterclockwise one quarter turn until the socket pins have opened.

7 Insert the EPROM/EEPROM, aligning the notches on the EPROM/EEPROM and the socket as shown in Figure. Tighten the socket by turning the screw clockwise.



Inserting EPROM/EEPROM into Socket

8 Check the pins to make sure that they are all seated properly in the socket.

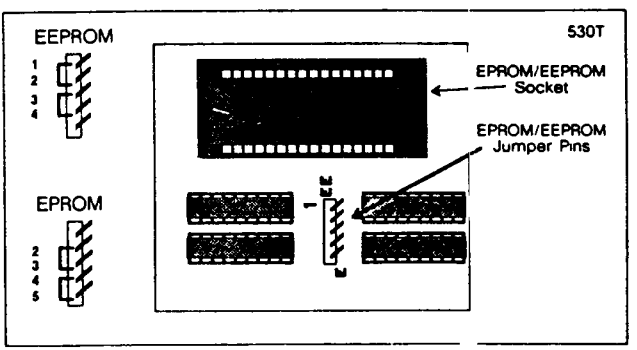
9 For 530Ts only—if you are installing an EEPROM, place jumpers on the EPROM/EEPROM jumper pins 1–2 and 3–4. If you are installing an EPROM, place jumpers on pins 2–3 and 4–5 Refer to Figure.

CAUTION

If the jumpers are set incorrectly and a programmed EPROM/EEPROM is installed, random system operation may result and the EEPROM program may be damaged or erased.

If the jumpers are in the wrong position when the EEPROM is programmed, the EEPROM program will not be correct and random system operation may result.

10 Install the P/C in its base and enable power



Location of 530T EPROM/EEPROM Jumper Pins

APPENDIX A
SPECIFICATIONS

520C/530C Specifications

Environmental Specifications (All P/C models)

Storage Temperature

40° to 85° C, 40° to 185° F

Operating Temperature

0° to 60° C, 32° to 140° F

Relative Humidity

5% to 95% noncondensing

Vibration

Random, NAVMAT P-9492
0.04g^2/Hz spectral density 20 to 2KHz
3dB rolloff per octave
80-20 Hz and 350 to 2KHz

Electric Noise Immunity

Conducted noise NEMA ICS 2-230.45
MIL-STD-461B, Part 4; CS01, CS02, CS06
IEEE 472, 2.5kV

Radiated noise MIL-STD-461B, Part 4,
RS01, RS02, RS03 (10V/M)

Electrostatic discharge. MIL-STD-883 (22kV)

System Isolation

Isolation (user-side to P/C-side) 1500V rms

General Specifications (All P/C models)

Input Power

Provided by power supply module
Model 500-2151 for user-supplied 110/220 VAC
Model 500-2153 for user-supplied 24 VDC

Maximum power drawn from base by 520C/530C
11 W @ +5 VDC, 0.3 W @ -5 VDC

Memory Backup

520C/530C EPROM (TI part #2587681-8012)
Battery backed-up static RAM

Battery Backup

3 V lithium battery (TI part #2587678-8005)
3 years minimum storage (0° to 60° C)
6 months typical backup (0° to 60° C)

Communication Ports

RS-232-C/RS-423 all models
RS-422 all models

User Memory Capacity

2K, 4K, 8K, or 12K of RLL memory, depending on the model.

Corrosion Protection

All parts are of corrosion-resistant material or are plated or painted as corrosion protection

Agency Approvals
(All P/C models and power supply)

UL Listed (Industrial Control Equipment)
CSA Certified (Process Control Equipment)
FM listed, Class 1, Division 2, Hazardous Location

APPENDIX A - SPECIFICATIONS

530T Specifications

Environmental Specifications (All P/C models)

Storage Temperature

-40° to 85° C, -40° to 185° F

Operating Temperature

0° to 60° C, 32° to 140° F

Relative Humidity

5% to 95% noncondensing

V bration

Random NAVMAT P-9492 or IEC 68-2-34, Test Fdc with 0 04g^2 Hz, 80-350 Hz, and 3dB rolloff per octave
80-20 Hz and 350 to 2KHz, at 10 min/axis
Sinusoidal IEC 68-2-6, Test Fc
0 15 mm peak-to peak 10-57 Hz,
1 0g, 57-150 Hz

Electric Noise Immunity

Conducted noise IEC 801, Part 4, Level 3
MIL STD 461B Part 4, CS01, CS02, CS06
IEEE 472, 2 5kV, IEC 255-4, Appendix E
EEC 4517/79 Com(78) 766 Final, Part 4

Radiated noise IEC 801, Part 3, Level 3
MIL STD 461B Part 4, RS01, RS02

System Isolation

User s ..e to P/C-side, 1500V rms
Common to Common, 1500V rms

Electrostatic Discharge

IEC 801, Part 2, Level 4 (15kV)

Pollution Degree

2, IEC 664, 664A

Impact Shock

IEC 68-2-27, Test Ea, Half Sine, 15g, 11ms

General Specifications (All P/C models)

Input Power

Provided by power supply module
Model 500-2151 for user-supplied 110/220 VAC
Model 500-2153 for user-supplied 24 VDC
Maximum power drawn from base by 530T
14 W @ +5 VDC 0 2 W @ -5 VDC

Memory Backup

530T EEPROM (TI part #2587681-8020)
Battery backed up static RAM

Battery Backup

3 V lithium battery (TI part #2587678-8005)
3 years minimum storage (0° to 60° C)
6 months typ cal backup (0° to 60° C)

Communication Ports

RS-232 C/RS-423 all models
RS-422 all mode s

User Memory Capacity

2K, 4K, 8K, or 12K of RLL memory, depending on the model

Corrosion Protection

All parts are of corrosion-resistant material or are plated or painted as corrosion protection

Agency Approvals
(All P/C models and power supply)

UL Listed (Industrial Control Equipment)
CSA Certified (Process Control Equipment)
FM listed, Class I, Division 2, Hazardous Location

Guidelines for Installing the Power Supply

Choosing a Location

The slot to the left of the controller slot in an I/O base is designated A and the one next to it, B. The remaining slots are I/O slots, which are numbered from right to left beginning with slot 1 in the position left of slot B.

The power supply module is double-wide and occupies two slots in the I/O base. Install the power supply in slot A or slot B of Models 500-5848, 500-5884, and 500-5892. If the power supply is inserted into slot A it also covers slot B, and if inserted into slot B it also covers I/O slot 1. See Figure 2.

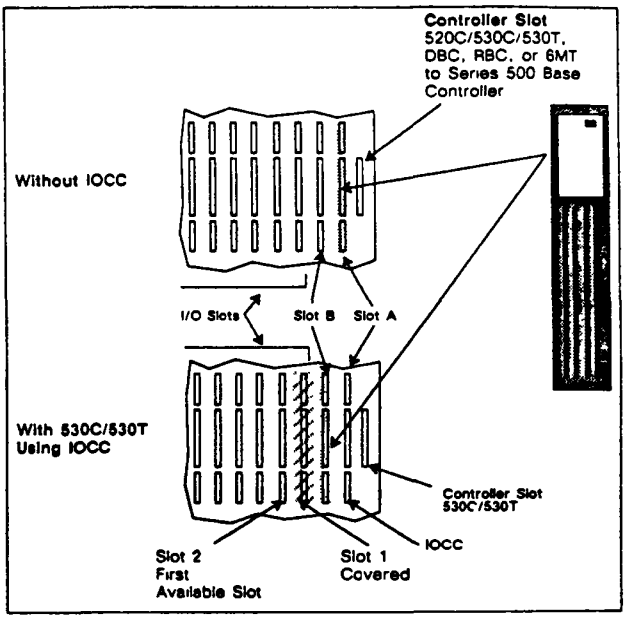


Figure-2 Power Supply Location in Models 500-5848, 500-5884, and 500-5892

Guidelines for Installing the Power Supply (Continued)

Insert the power supply into slot B of the Model 500-5840 adapter base, slot A is reserved for an IOCC. See Figure 3.

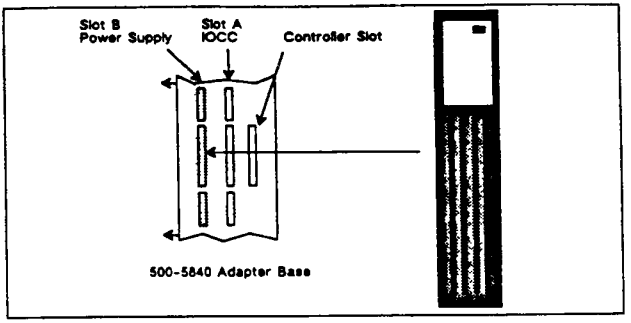


Figure-3 Power Supply Location in Model 500-5840 I/O Base

NOTE: Be sure the internal voltage selector is set properly before you insert the Model 500-2151A power supply into the base

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WARNING

To minimize risk of fire hazard or electrical shock, never insert or remove the 110/220 VAC Power Supply Module when AC input power is enabled to the base.

Inserting the Module

After selecting the module location, examine the base edge card connectors and be sure all keys have been removed. Orient the power supply as shown in Figure 4 and push it carefully but firmly into the slots Exercise caution not to damage the edge card at the back of the module. When the module is fully seated in the base, the tabs at the top and bottom of the base hold the module in place.

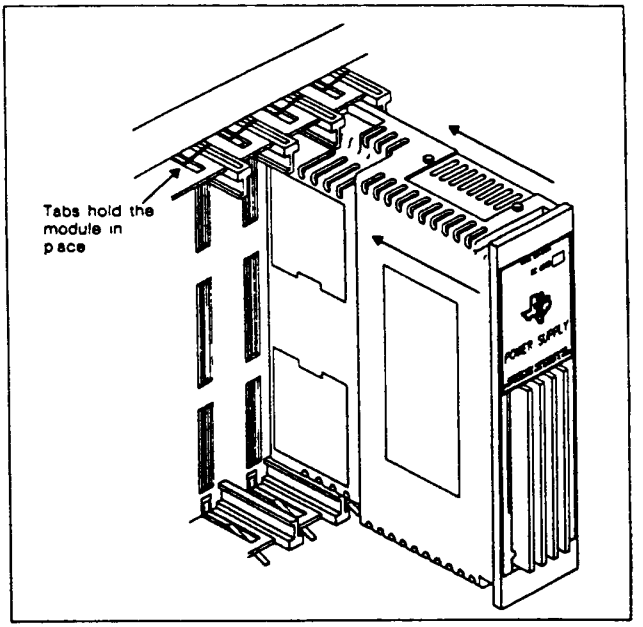


Figure-4 Inserting the Power Supply Module

CAUTION

Be sure the tabs are fully engaged after inserting the module. If they are not, the module might fall out, causing damage to the module and/or suspending operation of the system.

Removing the Module

To remove the module from the I/O base, pull the tabs away from the module and slide the module out of the base Exercise caution in removal to prevent damage to the edge cards at the back of the module.

00 01 15 04 11 07

Data Sheet

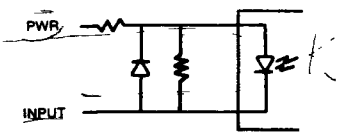
INDUSTRIAL CONTROLS

Series 500 Programmable Controller Discrete Input Modules

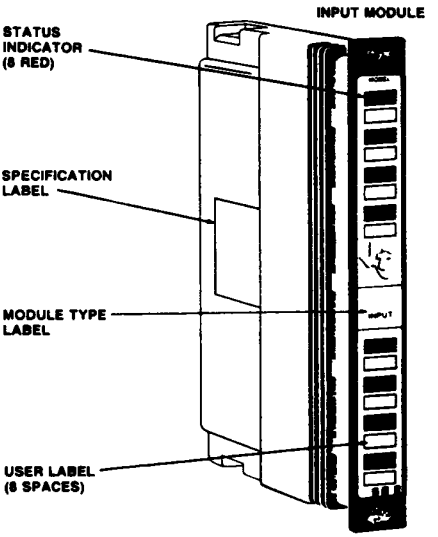
Specifications

Inputs Per Module - 8

TTL Input Module
Input Voltage
3 5 VDC mn
15 VDC max
Input Current (See below)
1 to 9 mA
3 mA @ 5 0 V (Nominal)



TYPICAL TTL INPUT MODULE



530-8103-6008

24 VDC Input Modu e
Input Voltage
9 VDC mn
30VDC max
Input Current
2 to 15 mA

24 VAC/DC Input Module
Input Voltage
20VAC/DC mn
36 VAC max
40 VDC max
Input Current
5 to 15 mA

48 VAC/DC Input Module
Input Voltage
40 VAC mn
36 VDC mn
56 VAC max
70 VDC max
Input Current
4 to 15 mA DC
5 to 15 mA AC

110 VAC Input Module
Input Voltage
85 VAC mn
132 VAC max
Input Current
5 to 20 mA

220 VAC Input Module
Input Voltage
170 VAC mn
260 VAC max
Input Current
5 to 20 mA

Operating Temperature
0° to 60°C (32° to 140°F)

Humid ty, Relative
5% to 95%

\ bration
NAVMAT P9492 ' Navy Manufacturing Screening Program

Description

The Series 500 Discrete Input Module contains eight identical solid-state input circuits to accept the ON/OFF status of user devices such as pushbuttons, limit switches, and thumbwheels. The module senses an externally supplied ac/dc voltage. four input circuits per ac/dc supply. Six versions of the discrete input module are available:

- TTL Input Module (3.5 to 15 VDC), Model 500-5007
- 24 VDC Input Module (9 to 30 VDC), Model 500-5008
- 24 VAC/DC Input Module (20 to 36 VAC/DC), Model 500-5005
- 48 VAC/DC Input Module (40 to 56 VAC/DC), Model 500-5006
- 110 VAC Input Module (85 to 132 VAC), Model 500-5001
- 220 VAC Input Module (170 to 260 VAC), Model 500-5002

Each input circuit maintains 1500 VRMS isolation between the external electrical environment and the internal logic signals. Each input has a red status indicator, visible from the front of the module, which lights when the corresponding input is turned on by the CPU.

Each type of input module also has a color code (see following table). The I/O base slot may be keyed to prohibit insertion of wrong type module.

MODULE COLOR CODES

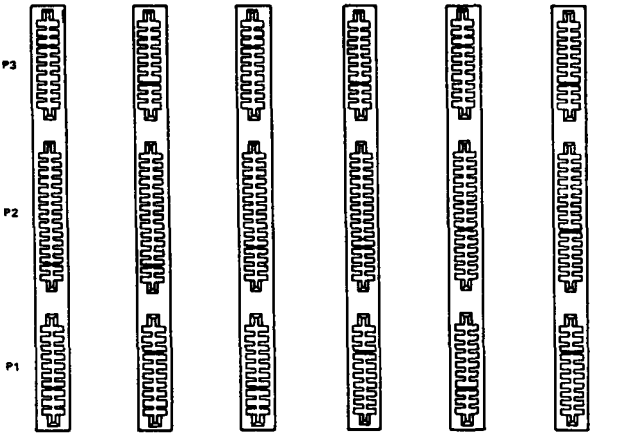
TTL	Blue
24 VDC	Blue
24 VAC/DC	Red/Blue
48 VAC/DC	Red/Blue
110 VAC	Red
220 VAC	Red

USER NOTES

- Each input has a red status indicator.
- A place is provided on the front of each module for users to mark the input circuit with their designation.
- The user must supply ac/dc voltage to the module.
- Wiring is connected to base, not the module.
- The input module may be inserted into any of the I/O base slots. Keys are supplied with the module to allow users to key the I/O base slot selected for the module. Keying prevents other types of modules being mistakenly inserted. (See keying diagram.)

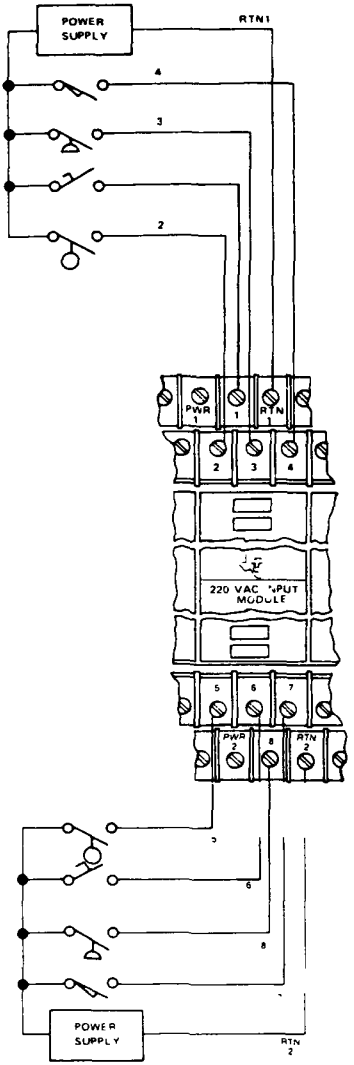
	TIME		ON STATE INPUT CURRENT	MAX INPUT CURRENT TO GUARANTEE TURN OFF	MIN INPUT IMPEDANCE WHICH WILL ALLOW TURN OFF	MAX TURN OFF VOLTAGE
	TURN ON	TURN OFF				
TTL	0.3 ms min 1 ms max	0.5 ms min 2 ms max	1.9 mA	0.5 mA	10K 5.25 V source	1.0 V
24 VDC	1 ms min 5 ms max	2 ms min 7 ms max	2.15 mA	0.5 mA	47K 30 V source	3.0 V
24 VAC/DC AC DC	3.5 ms min 25 ms max 3.5 ms min 10 ms max	3.5 ms min 15 ms max	5-15 mA	2 mA	18K, 36 V source 15K 40 V source	6.0 VRMS 8.0 VRMS
48 VAC/DC AC DC	3.5 ms min 25 ms max 3.5 ms min 10 ms max	3.5 ms min 15 ms max	5-15 mA 4.15 mA	1.5 mA 2 mA	24K 56 V source 27K, 70 V source	10 VRMS 15 VDC
110 VAC	3.5 ms min 25 ms max	3.5 ms min 20 ms max	5.20 mA	2.5 mA	46K 132 V source	25 VRMS
220 VAC	3.5 ms min 25 ms max	3.5 ms min 20 ms max	5.20 mA	3.5 mA	91K 260 V source	50 VRMS

KEYING DIAGRAM FOR DISCRETE INPUT MODULE

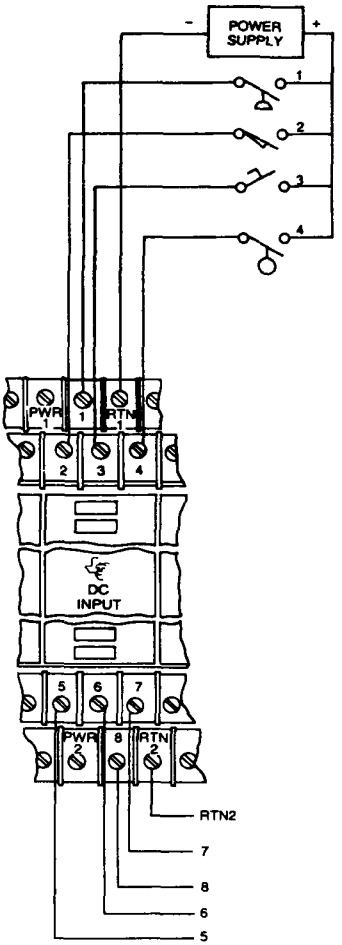


I/O SLOT TTL MODULE	I/O SLOT 24 VDC MODULE	I/O SLOT 24 VAC/DC MODULE	I/O SLOT 48 VAC/DC MODULE	I/O SLOT 110 VAC MODULE	I/O SLOT 220 VAC MODULE

CONNECTION DIAGRAM FOR
DISCRETE NPUT MODULE



DC INPUT WIRING
(Except TTL Input)



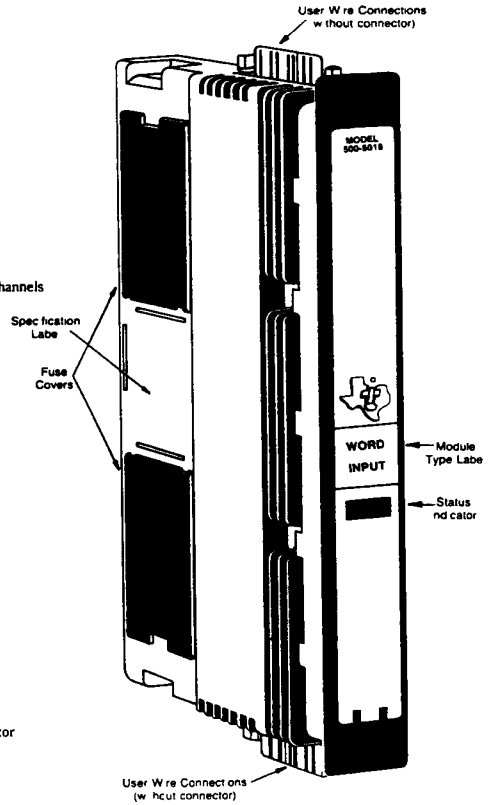
Data Sheet

INDUSTRIAL CONTROLS

Series 500 Programmable Controller
Model 500-5018 Parallel Word Input Module

Specifications

Inputs per Module
8 channels (multiplexed)
Input Signal types
TTL
CMOS
Up to 28 volts DC
Update Time
Less than or equal to 8 milliseconds for all channels
Data Active Level
Low true or high true
(User selectable on I/O base)
Strobe Active Level
Low true or high true
Module or externally generated
(User selectable on I/O base)
Input Word Length
16-bits
Isolation
Channel to Programmable Controller
1500 volts RMS
Binary Output to Programmable Controller
16-bit data word
User Power Requirements
20 to 30 volts DC at 0.25 AMPS
(Including no more than 0.4 volts ripple)
UL Listed Class 2
Operating Temperature Range
0 to 60 Degrees C
Storage Temperature Range
-40 to 85 Degrees C
Operating Humidity Range (non condensing)
0 to 95 % relative humidity
Keying
Can be keyed on I/O base and user connector



Introduction

The Mode 500 5018 Parallel Word Input Modu e provides the capability of interfacing the Programmable Controller (PC) to such devices as humbwheel switches ana og to digital converters and any other device that provides a multib t parallel word code such as BCD, GRAY, or other binary code *This module is designed to be used with the* Series 500 Programmable Controllers and I/O family

This data sheet describes how the modu e is installed how the module functions with the Programmable Controller and how to use the many features of this module

Description

The Model 500-5018 Parallel Word Input Module is designed to accept eight 16-bit parallel words of data in binary code and transmit that data to the CPU for process ing *The 16 parallel data lines are wired directly from the* fie d device to the field terminal screw connections on the top and bottom of the module

Each module can multip ex e ght 16 bit inputs by using strobing techniques The strobes operate at TTL leve s only and are provided to ensure that only one channe s read at a t me Wiring of all eight 16 b t inputs is in paralle and the strobing selects which input is read

Data lines are connected to terminals DB 1 through DB 16 with DB 16 being the east significant data bit (See Figure 1) All of the inputs can be considered high true or low true User selectable) The modu e has an update time of less than or equal to eight milliseconds for all eight channels

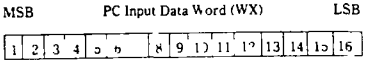


Figure 1
Data Word Format

Module Timing Characteristics

In order to fully comprehend the operating characteristics of the Model 500 5018 Paralle Word Input Module the timing characteristics must be understood The module operates asynchronous y from the PC This means that the PC scan time and the module scan time are not syn *hron zed together* The module scan cons sts of conver ting all input channe s a nd storing the convers on data in the buffer memory The channe s are converted one at a t me The update time assoc ated w th the eight channe s is less than eight milliseconds The m dule will n ot update ts buffer memor n the modu e f the PC s accessing the module For instance if the module has just updated chan nel 3 when the PC accesses the module then channel 3 will have the most recent data then channel 2 then 1 then 8 then 7, then 6 then 5, and then 4

Since any input channel can be the last one converted before the PC reads the module, there is no way to deter mine *which channel has the most recent data Since all* channe s are converted within eight milliseconds of each other this will not make any difference n most cases

Jumper Descript ons

All user options are se ected via user jumper wires on the Series 500 base All selections are made without removing or disassembling the module Replacement of the modu e with another of the same type will not alter the option(s) selected The user selectable options are data active level which may be low true or high true, strobe active level which may be low true or high true and the strobe source wh ch may be either m dule supplied (generated by the module) or user supplied generated by the field dev ce ex ternal to the modu e Figure 2 and the following paragraphs describe n detail the jumper se ections and show the ocat ons of the jumpers on the I/O base

Jumper Name	Connected	Not Connected
(a) Data Active Level	High True	Low True
(b) Strobe Active Leve	High True	Low True
(c) Strobe Source	User Supplied	Module Supplied

Figure 2.
Jumper Selections

Data Active Level

The Data Active Level jumper selects whether the incom ing data words are low true or high true Low true data means that for input leve s below 0 8 volts the incoming bit in the binary data word s set to a 1 for that data line On the other hand high true data means that for input levels above 2 0 volts the incoming bit in the binary data word s set to a 1 and any voltage less than 0 8 vo ts for the data line will be set as a 0

The 500 5018 Parallel Word Input Module can accept any vo tage on the data lines from 0 to +28 volts DC Table 1 shows voltage leve s (ranges) for both low true and high true and the state to which the bit for the data line will be set

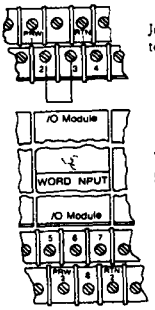
Vo tage Ranges of the Data Lines

	0 to 0 8 V DC	0 8 to 2 0 V DC	2 0 to 28 0 V DC
Low True	Set to	Indeterminate	Set to 0
High True	Set to	Indeterminate	Set to 1

Table 1
Data Input Switching Levels

The module loading on the data lines will not exceed a single TTL load at TTL input voltage levels. That is, a current of 1.6mA maximum at 0.4 volts and a current of 40uA maximum at 2.4 volts. For high voltage levels at the data inputs, the current will be 2mA maximum at 28 volts.

Figure 3 shows the location of the Data Active Level jumper on the I/O base.



NOTE

Jumper needs to be connected only to the top of the module.

CAUTION

To avoid damage to the Word Input Module or system under control, the user should verify that his field installed wiring, including option straps, are wired in accordance with wiring instructions as included with the Programmable Control System.

Figure 3
Data Active Level Jumper Location
(On I/O Base)

Strobe Active Level

The Strobe Active Level jumper selects whether the strobe lines are low true or high true. Low true strobe means that for input voltage levels below 0.8 volts the incoming strobe will cause the Word Input Module to read the channel that corresponds to the strobe. On the other hand, high true strobe means that for input voltage levels above 2.0 volts the incoming strobe will cause the Word Input Module to read the channel that corresponds to the strobe and any voltage less than 0.8 volts the Word Input Module will not read the channel.

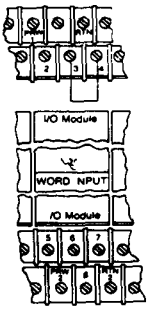
Table 2 shows the voltage ranges for the strobe lines. **Note that the switching levels are the same as required for the data lines, but that the maximum input voltage is 5.25 volts DC for the strobe lines rather than 28 volts DC allowed for the data lines.**

Voltage Ranges of the Strobe Lines

	0 to 0.8 VDC	0.8 to 2.0 VDC	2.0 to ≥ 25 VDC
Low True	Reading Data	Indeterminate	Not Reading Data
High True	Not Reading Data	Indeterminate	Reading Data

Table 2.
Strobe Switching Levels

Figure 4 shows the location of the Strobe Active Level jumper on the I/O base.



NOTE

Jumper needs to be connected only to the top of the module.

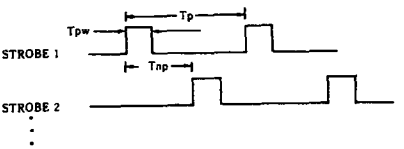
CAUTION

To avoid damage to the Word Input Module or system under control, the user should verify that his field installed wiring, including option straps, are wired in accordance with wiring instructions as included with the Programmable Control System.

Figure 4
Strobe Active Level Jumper Location
(On I/O Base)

Strobe Source

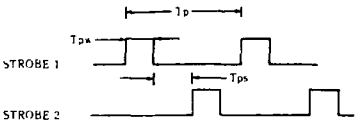
The Strobe Source jumper selects whether the strobe pulses are module supplied (generated by the module) or user supplied (generated externally to the module). Figure 5 shows the period (Tp), pulsewidth (Tpw), and the next pulse (Tnp) of the module supplied strobes.



Where Tp = 8000 uS minimum, 8800 uS maximum
Tpw = 5 uS minimum, 50 uS maximum
Tnp = 1000 uS minimum, 1100 uS maximum

Figure 5
Timing of Module Supplied Strobes
(High True Strobe)

Figure 6 shows the period (Tp) pulse width (Tpw) and the pulse separation (Tps) requirements for the user supplied strobes



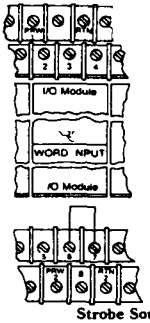
Where Tp = 8000 uS minimum No maximum
Tpw = 2 0 uS minimum No maximum
Tps = 998 uS minimum No maximum

Figure 6
Timing Requirements for User Supplied Strobes
(High True Strobe)

The data must be valid (remain the same state) for a minimum of 1 0 uS before the strobe pulse goes inactive In other words there must be minimum of 1 0 data setup

One should be cautioned that for the user supplied strobes if more than one strobe is *active at the same* time the Word Input Module **will not read** data on any of the input channels As soon as only one strobe becomes active the Word Input Module will again read data into the module The user should also be aware that the user supplied strobes may be *active in any order that the user* prefers The only timing requirements that must be followed are that the pulse width must be at least 2 0 uS long and that the strobes must be at least 998 uS apart An example if only one channel were to be used then the data for that one channel could be strobed into the module every 1000 uS or 1 mS

Figure 7 shows the location of the Strobe Source jumper on the I O base



NOTE
Jumper needs to be connected on y to the bottom of the module

CAUTION

To avoid damage to the Word Input Module or system under control the user should verify that his field installed wiring, including op*tion straps, are wired in accord*ance with wiring instructions as included with the Programmable Control System

Figure 7.
Strobe Source Jumper Location
(On I/O Base)

Installation

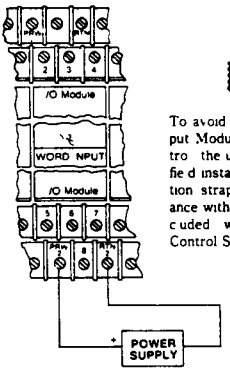
The Model 500 5018 Parallel Word Input Module was designed to be used with the Series 500 Programmable Controllers and I/O bases The module can be placed in any I/O slot of any Series 500 I/O base When placed in the I/O base the PC automatically determines the type of module and where it is placed After the module is plugged into the I/O base Auxiliary Function 12 (Complete Restart) should be performed on the PC so that the PC can immediately log in the module The module will also be logged into the I/O map if any one of the following operations is performed once

1 Cycle the sequencer s A/C power
2 Auxiliary Function 10 (PC power up restart)
3 Auxiliary Function 11 (PC partial restart)
4 Perform one Program Mode to Run mode transition on the sequencer
5 Wait for the sequencer to scan the program a maximum of 8192 times (Example Wait 2 minutes for a 15 mS scan)

Then using the Video Programming Unit (VPU) Auxiliary Function 43 (I O Base Map) can be performed or the PC so that the actual I/O addresses can be verified The Model 500 5018 Parallel Word Input Module appears as eight word inputs (WX)

Power Supply Selection

The Model 500 5018 Parallel Word Input Module has been specially designed to use a low cost user power supply Each module requires only a single voltage source of 20 to 30 volts DC at 0 25 Amps User power supply must not have a ripple greater than 0 4 volts A UL Class 2 power supply must be used to insure UL listing compliance on this module The power supply connections are shown in Figure 8



CAUTION

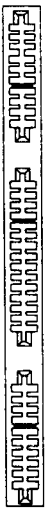
To avoid damage to the Word In put Module or system under con tro the user should verify that h s fie d installed w ring including op tion straps are wired in accord ance with wiring nstruct ons as in c uded with the Programmab e Control Svstem

NOTE

Power needs to be connected only to the bottom of the modu e

Figure 8
Power Supply Connections
(On I/O Base)

Key ng D agram
for
Word npu Modu e



Key ng the /O Base Slot as shown prevents an ncorrect module type from being inserted nto this s ot Use needlenose p ers to nsert the keys Insert the keys with the base power off

00 01 27 04/11/07

Wiring

Wiring of the module consists of two parts wiring the power supply and jumpers and wiring the Word Input data lines and strobe lines All power to the module and the PC must be turned off before any wiring of the system

The power supply wiring should be separated from the signal wiring due to the possibility of injecting noise on the low level input data lines The Model 500-5018 Parallel Word Input Module's power supply terminals are located on the I/O base and the data and strobe lines are on the module connectors for maximum separation (See Figure 8 for power supply connections)

The data lines are connected to terminals DB1 through DB16 with DB16 being the least significant data bit The module has two edge card connectors for the data and strobe line wiring These connectors include a wire strain relief that should be used in one of two ways Use the metal tie down bar included with the connector or use a regular cable tie Either way is sufficient to hold the cabling The connectors use screw pressure plate termination points and therefore need no soldering The connectors plug into both the top and bottom of the module in only one direction The termination connections are shown in Figures 9 and 10

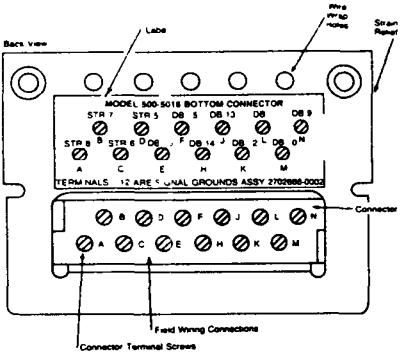


Figure 10.
User Word Input Connections as Shown on the User Connector Bottom Connector

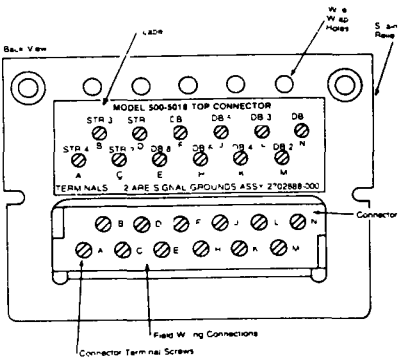


Figure 9
User Word Input Connections as Shown on the User Connector Top Connector

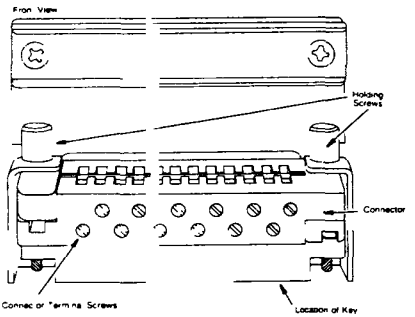


Figure 11
Connector's Front View

NOTE

Keying the User Connector prevents the connector from being inserted backwards on the I/O module The key is placed between slots one and two

The strobe lines are connected to terminals STR1 through STR8 Strobe line number one (STR1) corresponds to word number one (WX1) The module supplied strobes are capable of driving up to 10 feet of AWG#20 ribbon cable with interleaved signal returns terminated at both ends or 30 feet of AWG#18 shielded twisted pair cable

The shie ding for the cab e sh ou d alwa s be terminated on the source end of the signa Therefore the originating po nt for the strobe s gnal should be the shield termina tions po nt There should not be any shield termination at the Word Input module **Terminals 1 through 12 are for signal returns, not shield termination points**

The data lines should also have the shie ds terminated at the source of the s gna and only return lines (signa grounds) be connected to term nals 1 through 12 Because the nput data lines are multip exed the devices connected to them must have tri state outputs open collector out puts or be diode isolated

F gure 12 shows block ng diodes for multiple thumbwheels using high true strobes

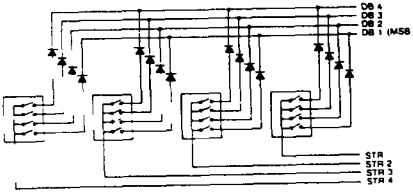


Figure 12
Blocking Diodes for Multiple Thumbwheels
(High True Strobe)

CAUTION

When us ng the strobe lines to power the thumbwheel switches (F gure 12) ong line engths from the field input to the module may degrade the speed (rise time and fall time) and vo tage levels into the module

When us ng thumbwheels with a low true strobe, the blocking diodes **must be reversed** from the direction shown in Figure 12

After the user power supply s on and the module is logged into the I/O map the module s red indicator (status in dicator) on the front bezel should ight to indicate that the module has passed its self diagnostics and is operating If the nd cator is not lighted something is wrong with either the insta at on or the module See the troubleshooting in struct ons

Troubleshooting

If the module appears to operate incorrectly the following steps should be taken

Symptom	Probable Cause	Corrective Action
No Front Light	Not Logged in O Map	Log Module into O Map
No Front Light	Blown Fuse	Replace Fuse
No Front Light	No User Power	Check Power Supply
No Front Light	Base PC Power Off	Turn On Base PC Power
Incorrect Readings	Wrong Connections	Trace Signal Wiring
Incorrect Readings	Noise on Signal Wire	Use Shielded Wire
ncorrect Readings	Wrong Jumpers Selected	Check Jumpers

If these steps do not solve the problem call Texas Instruments Technical Service at (615) 461 2501

Caring for the Module

These modules are rugged industrial devices but they should be handled with the same care given any other piece of electronic equipment Keep the module dry and don t touch the edge connectors

CAUTION

The components of the Word Input module can be dam aged by static elec ric ty discharges

Static electricity build-ups are more likely to occur when the natural humidity of the air is low (during winter or in areas with dry climates) To avoid damaging the module, touch any grounded metal object (i e NEMA panel machine sup ports etc) before handling the module

Fuse Replacement

There is one User replaceable fuse which can be accessed to by removing the fuse cover on the side of the module (bottom cover) This fuse will blow if the user power sup ply inputs an overcurrent into the module The following are replacement fuses and have a 500 mA current rating

Manufacturer	Part Number
1 Sano Industrial Corp	MT4 500mA (20 mm long & 5 mm diameter
2 Littelfuse	212 500
3 Bussmann	GDB 500

WARNING

Do not use s ow blow replacement fuses in the Word Input modu e This action cou d resu t in permanent damage to the module

00 01 29 04 11 07

DESCRIPTION OF THE MODULE

The Model 500-3031 LVDC 32 Point Output Module (which is shown in Figure 1) occupies one slot of an I/O base which is connected to a 520C, 530C, 560, or 565 Programmable Controller (P/C). It may also be used with a 5TI or PM550 P/C provided a Model 500-2161 6MT to Series 500 Base Controller is included in the module's base. The module receives power from the I/O base and uses at most 3 0 watts. (This figure should be used when constructing a power budget for the I/O base)

The LVDC Output Module provides 32 channels, with each channel providing voltage in the range of 20-30 VDC. The 32 channels are broken into two groups of 16 with the first group wired to a connector which plugs onto the top of the module, and the second group of 16 wired to a connector which plugs onto the bottom of the module. The two connectors are isolated from each other, which means that different power supplies could be used for each.

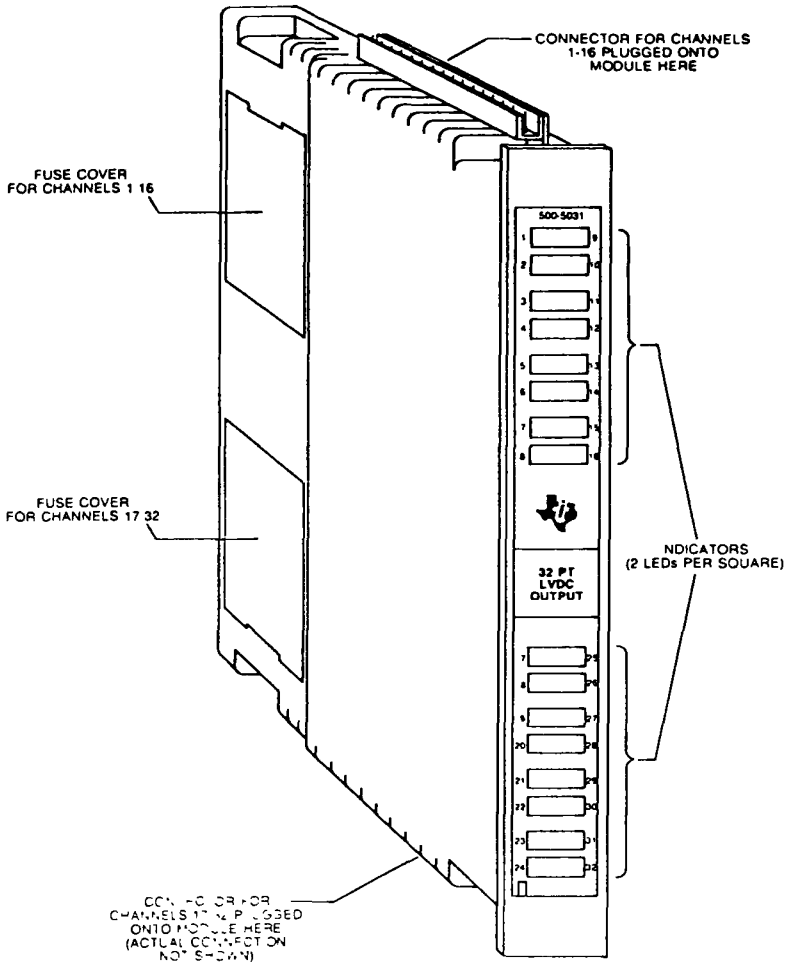
There are two positive power supply lines for the module: one is for channels 1 through 16 and is connected to the top of the I/O base, the other is for channels 17 through 32 and is connected to the bottom of the I/O base There are also two returns for the module the first return is for channels 1 through 16 and is connected to the top of the I/O base; the other return is for the remaining channels and is connected to the bottom of the I/O base

To indicate whether a channel is on, an LED indicator is provided on the front of the module for each channel. The indicator will be lit when the output circuit for the channel is active.

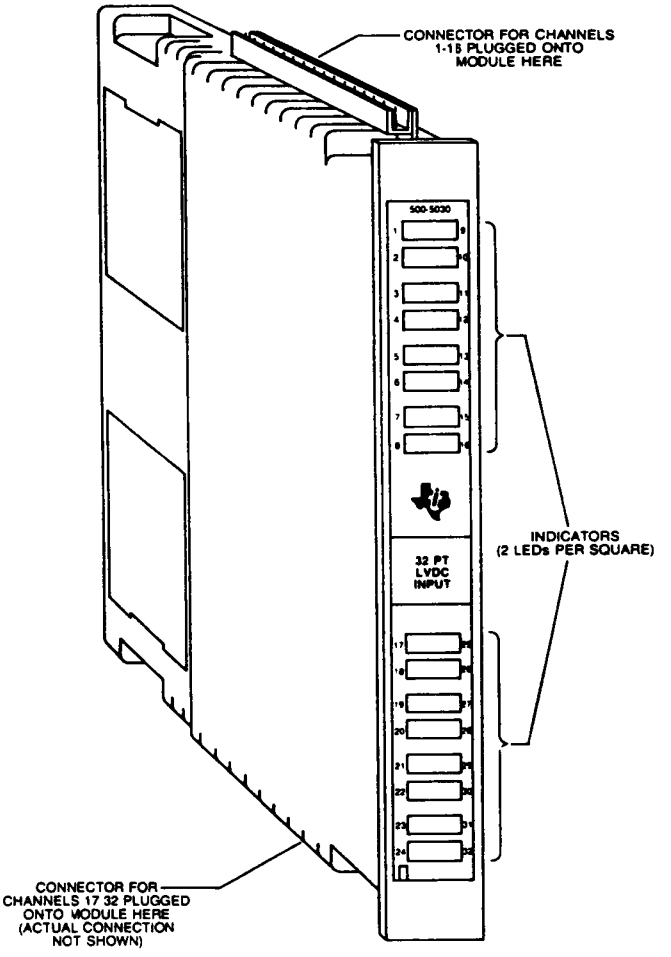
Electronic short circuit protection is provided for each of the eight groups of four channels. The circuit which provides this protection will sense when any of the four channels is carrying more than 0 6 amps. When the circuit senses more than 0 6 amp, the channel which has the excessive current as well as the other three channels will turn off.

The circuit will turn the channels back on a few milliseconds later and if the current is still more than 0.6 amps, the four channels will again turn off *The on and off cycle will occur so quickly that the indicators will only* appear dimmer than normal rather than blinking The output channel will be off even though the indicators are turning on and off. (More technically, the duty cycle will be short and the average current will be essentially zero.)

The channels are also protected by two, 8 0 amp fuses One fuse protects channels 1 through 16, and the other protects channels 17 through 32 If a fuse blows, all 16 channels will be inactive See the troubleshooting section on page 9 for information on replacing blown fuses



The LVDC 32 Point Output Module



The LVDC 32 Point Input Module

DESCRIPTION OF THE MODULE

The Model 500-5030 LVDC 32 Point Input Module (which is shown in Figure) occupies one slot of an I/O base which is connected to a 520C, 530C, 560, or 565 Programmable Controller (P/C). It may also be used with a 5TI or PM550 P/C provided a Model 500-2161 6MT to Series 500 Base Control er is included in the module's base. The module receives power from the I/O base and uses at most 3 0 watts (This figure should be used when constructing a power budget for the I/O base)

The LVDC Input Module can read up to 32 inputs through its 32 channels. An input channel will be "on" when the voltage is between 15-30 VDC and the current is in the range of 2-6 mA. The channel will be "off" when the voltage is less than 5 VDC. The maximum delay time for an off to on transition is 5 ms, for an on to off transition it is 8 ms For both off to on and on to off transitions, the minimum delay time is 2 ms (There are two returns for the 32 input channels· the first, common return is for channels 1 through 16 and is connected to the top of the I/O base, the second, common return is for the remaining channels and is connected to the bottom of the I/O base)

To indicate whether a channel is on, an LED indicator is provided on the front of the module for each input channel The indicator will be lit when the input circuit for the channel is active

32-point input/output modules

INSTRUCTION FOR THE USE OF THE I/O INTERFACE CONNECTOR ON 32 POINT MODULES

To disconnect:

1. Turn off the base power supply. Disconnect all power coming in through the channel wiring.

2. Partially disengage the two connector halves (see Figure 2) by inserting the blade of a small, flat-head screwdriver (i.e., .125" x .06" size) into the slot on the end of the connector assembly. Tw st the blade 1/4 turn in clockwise or counter clockwise direction.

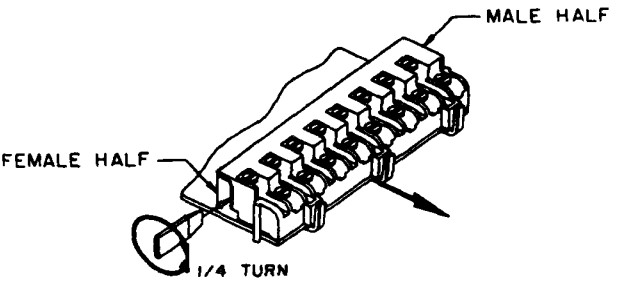


Figure 2. Connector with Both Halves Engaged

3. Firmly grasp the male half of the connector by the nearest outside edge. Apply slight pressure (3 to 5 pounds) while pulling the outside edge of the connector away from the module (see Figure 3).

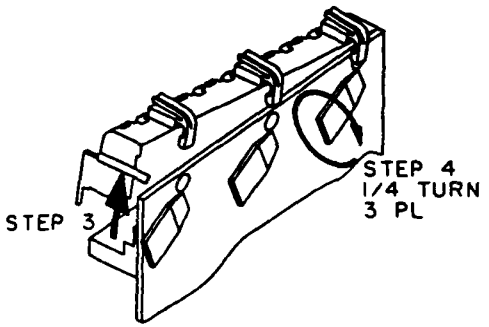


Figure 3. Apply Pressure on Male Half of Connector

4. While applying pressure as described in step 3, place the blade of the screwdriver under the nearest hook and twist 1/4 turn.

   This action releases the first hook and allows the connector half to begin a pivotal motion on the rear-most terminal.

5. Repeat steps 3 and 4 for the remaining two hooks (see Figure 3).

ALTERNATE METHOD

To simplify the removal process, press the nearest of the three hooks while the connector is partially disengaged (step 2). This will allow the hook to be freed from the PWB.

32-point input/output modules

To connect:

Read and understand the following five steps and two warnings before you begin the Connect procedure.

1. Tighten down any unused terminals on the connector.

2. Holding the connector by the outside plastic walls, slide the male half along the PWB until it engages the female half (see Figure 4).

WARNING

DO NOT attempt to force the assembly. No more than ten (10) pounds of force is required to connect the two parts. If it appears that additional force is required, check to ensure the pins on the rear of the male connector are not bent and are properly oriented.

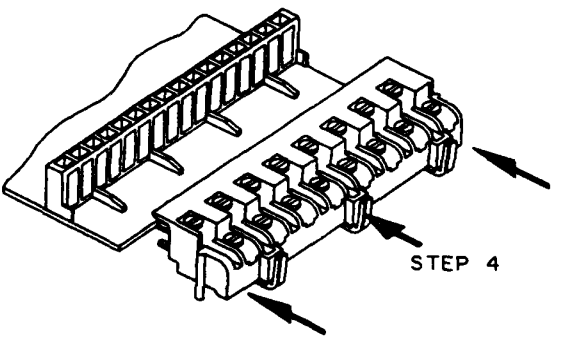


Figure 4. Aligning the Connector Halves

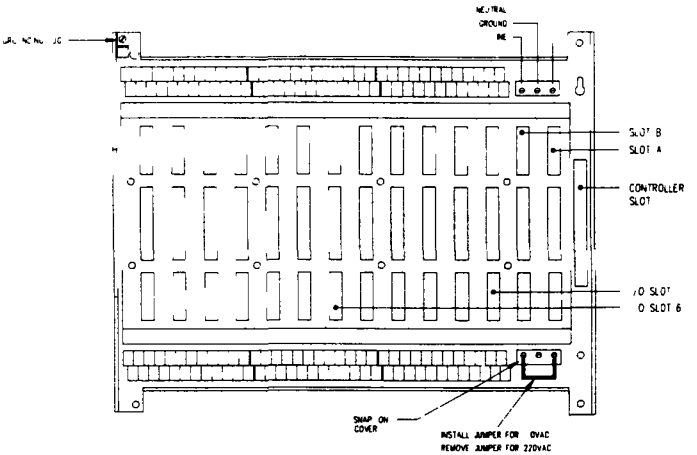
3. Engage the connector with the PWB by firmly pressing both halves together until the hooks snap into the aligning holes.

4. Apply an additional slight force near the center (shown in Figure 4) hook on the connector to insure that all three hooks are interlocked with the module's PWB.

WARNING

Ensure that the base power supply is turned off and all power coming in through the channel wiring is de-energized. This is essential for products being installed in Class I, Division 2, hazardous locations.

5. If the PWB does not have the three holes (shown in Figure 3) verify that the connector is fully mated with the PWB. Apply light pressure against the outer edges of the assembly as if beginning to remove the male half of the connector.



Slot Configurations for the Model 500-5884 12-slot Rackbase

The Model 500-5884 12-slot Rackbase is compatible with P/C Systems 530, 520C/530C, and 560/565 To use it with the PM550 or 5TI P/C Systems, you also need to use a Model 500-2161 6MT to Series 500 Base Controller

The 12-slot Rackbase contains a controller slot, slots A and B, and 12 slots for I/O modules See Figure 5

The Controller Slot

Plug the base controller into the controller slot Depending on your system, the base controller may be the P/C itself, a remote base controller, or a distributed base controller

Slots A, B, and the I/O Slots

Plug the double wide power supply module into slot A The power supply module covers both slots A and B The first I/O module fits into I/O slot 1 **Slots 6 and 7 will not accommodate double-wide modules that have two PWB edge connectors which take up two I/O slots.** These two slots are spaced farther apart than the others

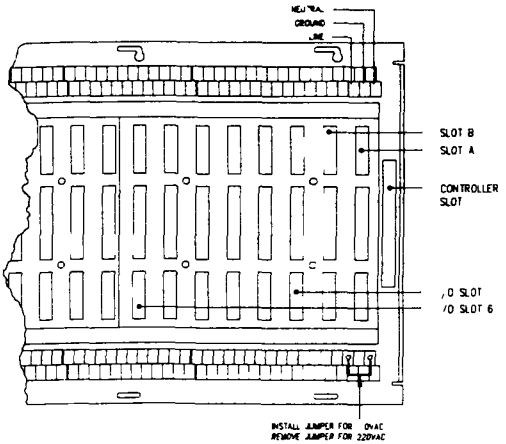


Figure 2: Slot Configurations for the Model 500-5892 6-slot Base and the Model 500-5848 14-slot Base

The Model 500-5892 6-slot Base and the Model 500-5848 14-slot Base are compatible with Programmable Controller (P/C) Systems 530, 520C/530C, and 560/565 To use them with the PM550 or 5TI P/C Systems, you also need to use a Model 500-2161 6MT to Series 500 Base Controller

The 6-s ot and 14 slot bases contain a controller slot, slots A and B, and six or fourteen I/O slots for I/O modules.

The Controller Slot

Plug the base controller into the controller slot Depending on your system, the base controller may be the P/C itself, a remote base controller, or a distributed base controller

Slots A, B, and the I/O Slots

Plug the double wide power supply module into slot A The power supply covers both slots A and B The first I/O module fits into I/O slot 1 **If you are using the Model 500-5848 14-slot base, note that slots 6 and 7 will not accommodate double-wide modules that have two PCB edge connectors which take up two I/O slots.** These two slots are spaced farther apart than the others

Data Sheet

INDUSTRIAL CONTROLS

Series 500 Programmable Controller Discrete DC Output Modules

Specifications
Outputs Per Module 8

24/48 VDC Output Module
Output Voltage
11 VDC min
56 VDC max
Output Source Current Per Circuit
2 A/point max
8 A total @ 50°C
4 A tota @ 60°C
5 A max surge current for 1 msec
ON State Voltage Drop
1 5 V @ 1 A oad current
OFF Sta e Leakage Current
1 mA max @ max VDC

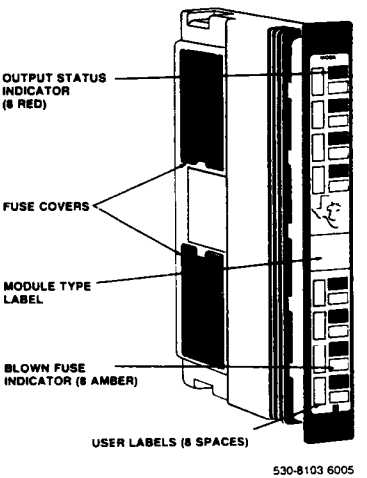
Total Modu e Output Current
8 A max

Operating Temperature
0° to 60°C (32° to 140°F)

Humidity Relative
5% to 95% noncondens ng

Vibration
NAVMAT P9492 Navy Manufacturing Screening Program

Fuses
Output
3 A/250 V SLO BLO
LITTLEFUSE® * 313003
Bussmann MDQ 3



530-8103 6005

*LITTLEFUSE® is a registered trademark of LITTELFUSE

Description

The Series 500 Discrete DC Output Module has eight identical solid state output circuits to control the ON/OFF status of user devices such as pilot lamps or solenoids. The module switches an externally supplied dc voltage. Eight output circuits per dc supply to control the user devices. One version of the Discrete DC Output Module is available:

- 24/48 VDC Output Module (11/56 VDC)
  Model 500-5013

Each output circuit maintains 1500 VRMS isolation between the external electrical environment and the internal logic signals. Outputs are fused to protect against overload currents and each output has an amber indicator which lights when a fuse blows in the respective output circuit. Output fuses are accessed by removing fuse covers located on the left or cast metal side of the module. A module must be removed from a base to replace the fuses. No wiring is connected to the module. All wiring is connected to the I/O base.

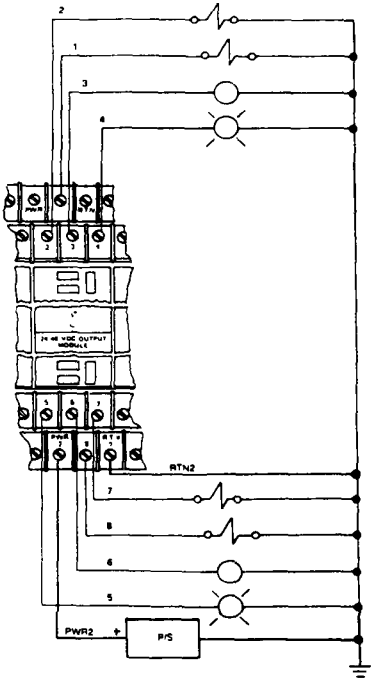
Each output has a red status indicator, visible from the front of the module, which lights when the corresponding output is turned on by the CPU. The blue label on the front surface of the module indicates a dc output module. The I/O base slot may be keyed to prohibit insertion of wrong type module.

USER NOTES

- Each output has a red status indicator.
- Each output is fused and has an amber blown fuse indicator. Fuses are accessed by snapping out the fuse covers with a flathead screwdriver.
- A place is provided on the front of each module for users to mark the output circuit with their designation.
- The user must supply dc voltage to the module by wiring to appropriate base (wiring connected to I/O base, not module).
- The DC output Module may be inserted into any I/O base slot. Keys are supplied with the module to allow users to key the I/O base slot selected for the module. Keying prevents other types of modules being mistakenly inserted.
- Load side indicators come on due to leakage current when no load is connected.

	TURN ON	TURN OFF
24/48 VDC	2.5 msec	2.5 msec

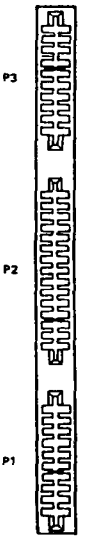
CONNECTION DIAGRAM FOR
D SCRETE DC OUTPUT MODULE



530-8103-6006

POWER SUPPLY SHOULD NOT BE CONNECTED TO TOP OF I/O BASE

KEYING D AGRAM FOR DISCRETE DC OUTPUT MODULE



I/O
SLOT
24/48 VDC
MODULE

KEYING THE I/O BASE SLOT AS SHOWN PREVENTS AN INCORRECT MODULE TYPE BEING INSERTED INTO THIS SLOT USE NEEDLENOSE PLIERS TO INSERT THE KEYS

530-8103-6007

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Data Sheet

INDUSTRIAL CONTROLS

Series 500 Programmable Controller Discrete AC Output Modules

Specifications
Outputs Per Module 8

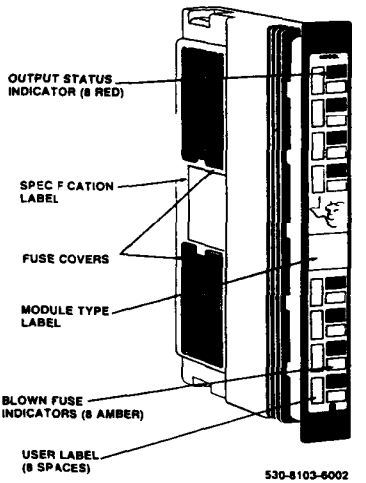
24/48 VAC Output Module
20 VAC min
56 VAC max
Output Source Current Per Circuit
1 A max @ 60°C
2 A max @ 40°C
45 A max surge current (½ cycle)
OFF State Leakage Current (RMS)
2 mA max @ 56 VAC
10 mA min load

110 VAC Output Module
85 VAC min
132 VAC max
Output Source Current Per Circuit
1 A max @ 60°C
2 A max @ 40°C
45 A max surge current (½ cycle)
OFF State Leakage Current (RMS)
2 mA max @ 110 VAC
10 mA min load

220 VAC Output Module
170 VAC min
260 VAC max
Output Source Current Per Circuit
1 A max @ 60°C
2 A max @ 40°C
45 A max surge current (½ cycle)
OFF State Leakage Current (RMS)
3 mA max @ 220 VAC
10 mA min load

Total Module Output Current
16 A max below 40°C
8 A max between 40°C and 60°C

Operating temperature
0° to 60°C (32° to 140°F)



530-8103-6002

Humidity Relative
5% to 95% noncondensing

Vibration
NAVMAT P9492, Navy Manufacturing Screening Program

Fuses
3 A/250 V SLO BLO
LITTLEFUSE® * 313003
Bussmann MDQ 3

*LITTLEFUSE® is a registered trademark of LITTLEFUSE INC

Description

The series 500 Discrete AC Output Module has eight identical solid state output circuits to control the ON/OFF status of user devices such as pilot lamps motor starters, or solenoids The module switches an externally supplied ac voltage four output circuits per ac supply to control the user devices Three versions of the Discrete Output Module are ava..able

- 24/48 VAC Output Module (20 56 VAC), Model 500 5010
- *110 VAC Output Module* (85-132 VAC), Model 500 5011
- 220 VAC Output Module (170 260 VAC), Model 500 5012

Each output circuit maintains 1500 VRMS isolation between the external electrical environment and the internal logic signals

In addition, each output is fused to protect against overload currents

Each output has a red load side status indicator, visible from the front of the module which lights when the corresponding output is turned on by the CPU Also each output has an amber indicator which lights when a fuse blows in the respective output circuit

Fuses are access b e to the user through a hatch located on the left, or cast metal side of the module The module must be removed from the base to replace a fuse No wiring is connected to the module All wiring is to the I/O base

The red label on the front surface of the module indicates an ac output module The I/O base slot may be keyed to prohibit insertion of wrong type module

USER NOTES

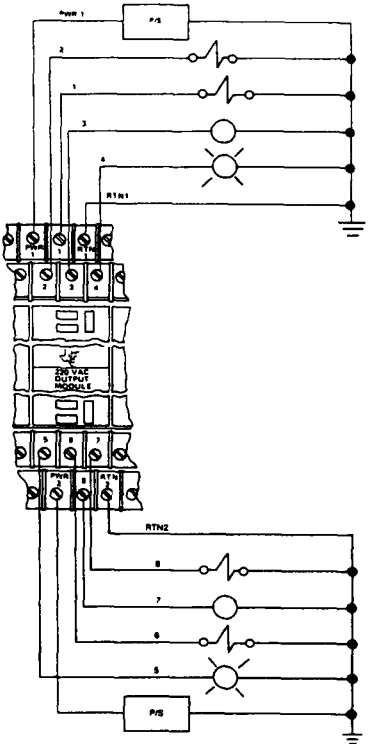
- Each output has a red status indicator
- Each output is fused and has an amber blown fuse indicator Fuses are accessed by snapping out the hatch with a flathead screwdriver
- A place is provided on the front of each module for users to mark the output circuit with their designation
- The user must supply an ac voltage to the module by wiring to the appropriate base terminal
- The AC Output Module may be inserted into any of the I/O base slots Keys are supplied with the module to allow user to key the I/O base slot selected for the module Keying prevents other types of modules being mistakenly inserted
- Load side indicators come on due to leakage current if no output load is connected

	TIME	
	TURN ON	TURN OFF
24/48 VAC	1 AC cycle	½ AC cycle
110 VAC	1 AC cycle	½ AC cycle
220 VAC	1 AC cycle	½ AC cycle

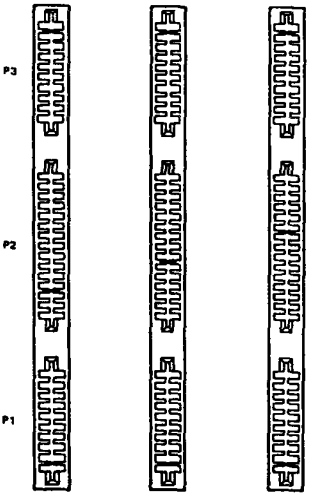
WARNING

DISABLE POWER TO THE I/O MOUNTING BASE BEFORE INSTALLING OR REMOVING ANY I/O MODULE

CONNECT ON D AGRAM FOR
DISCRETE AC OUTPUT MODULE



KEY NG D AGRAM FOR
DISCRETE AC OUTPUT MODULE



I/O
SLOT
24/48 VAC
MODULE

I/O
SLOT
110 VAC
MODULE

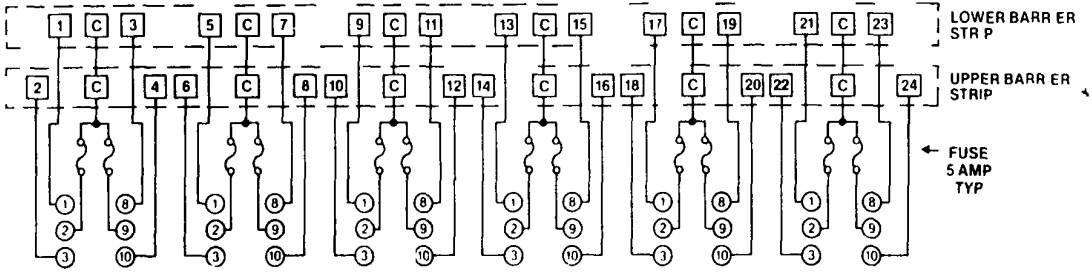
I/O
SLOT
220 VAC
MODULE

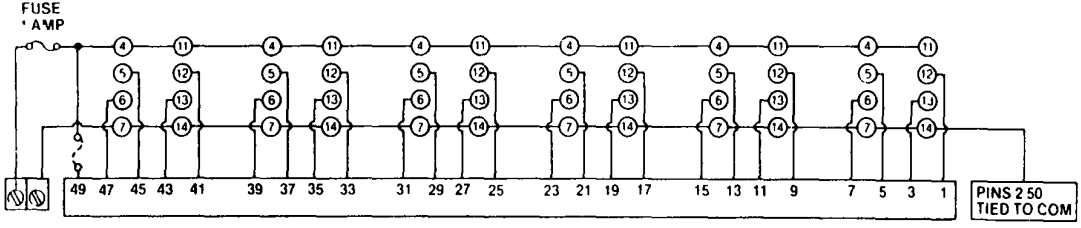
KEYING THE I/O BASE SLOT AS
SHOWN PREVENTS AN INCORRECT
MODULE TYPE BEING INSERTED
INTO THIS SLOT USE NEEDLENOSE
PLIERS TO INSERT THE KEYS

530-8103-6004

00 01 45 04 11 07

PB24Q QUAD PAK MODULE MOUNTING RACK SCHEMATIC AND LAYOUT TEMPLATE

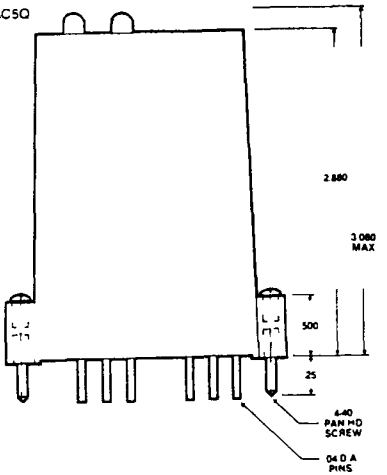


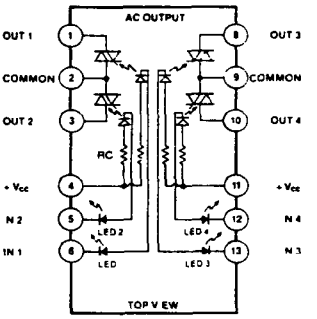


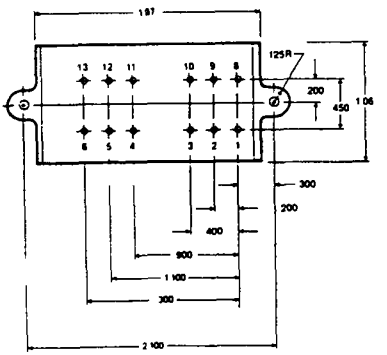
CONNECTOR END

00 01 47 04 11 07

AC OUTPUT
OAC5Q







POWER I/O MODULES

4 CHANNEL I/O MODULES — QUAD PAK™
AC OUTPUT MODULE — BLACK CASE
120/240 VOLT AC LINE

	MODEL OAC5Q
Control Voltage	**5 VDC**
Line Voltage — nominal	120/240 VAC
Operating Voltage Range	12 to 280 VAC
Peak Repetitive Voltage	500 V
Current Rating — at 20°C Ambient (per channel) at 45°C Ambient	3 amps 2 amps
1 Cycle Surge — amps peak	80
Minimum Load Current	20 ma
Output Voltage Drop — max peak	1.6 V
Off state Leakage — 60 Hz 120 V 60 Hz 240 V	3 ma rms 5 ma rms
Isolation Voltage — Input To Output	4000 Vrms
Control Pick-up Voltage	4 V
Control Drop Out Voltage	2.5 V
Control Voltage Range	4 to 8
Control Resistance (Rc in Schematic Diagram)	220 ohms
Control Input Current at nominal control voltage — per channel	12 ma

ADDITIONAL SPECIFICATIONS

Compatible with Opto 22 input modules for load status indication (outputs may drive inputs)

Directly compatible with PIA type ICs (6821, 6522, 8255A as typical), buffering not required

Operating Frequency: 25-65 Hz

Operating Ambient Temperature: 30 to + 70°C

Turn-on Time: 1/2 cycle maximum — zero voltage

Turn-off Time: 1/2 cycle maximum — zero current

DV/DT Off-State: 200V/μsec

DV/DT-Commutating: snubbed for rated load at .5 power factor

4 CHANNEL I/O MODULES — QUAD PAK™
DC INPUT MODULES — WHITE CASE
10-32 VOLT DC OR AC LINE

	MODEL IDC5Q
Control Voltage	**5 VDC**
nput L ne Voltage — max mum	32 VDC/AC
Input Vo tage Range	10 to 32 VDC — 15 to 32 VAC
Input Current at Max Line	25 ma
Input Al owed for No Output	1 ma (3 V)
Isolat on Input-To-Output	4000 Vrms
Output Trans stor	30 V Breakdown
Output Current	50 ma
Output Leakage 30 VDC — no nput	100 m croamps max
Output Voltage Drop	4 V at 50 ma
Log c Supply Voltage (Vcc)	4 5 to 6 V
Logic Supply Current — at nom nal log c volts	12 ma (per channel)
Input Res stance (R1 in Schemat c D agram)	1K ohms
Contro Res stance (Rc n Schemat c D agram)	220 ohms

ADDITIONAL SPECIFICATIONS

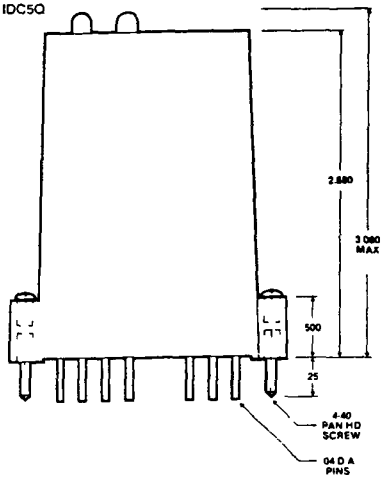
Co npatible with Opto 22 output modu es for oad status nd cation (outputs may drive nputs)

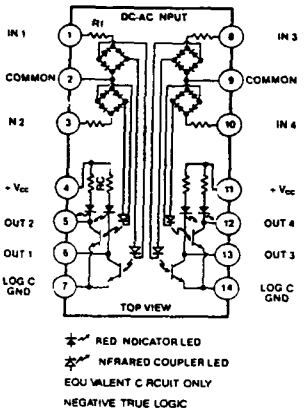
Turn-on Time: 5 m l seconds maximum

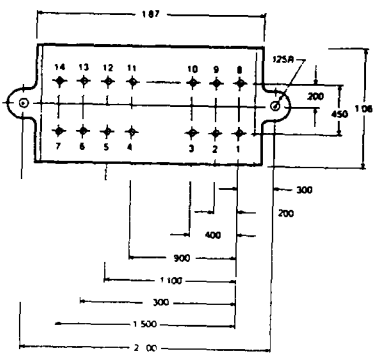
Turn-off Time: 5 mi liseconds max mum

Operating Ambient Temperature: −30°C to +70°C

DC INPUT
IDC5Q







INSTRUCTION MANUAL

FOR

REGULATED POWER SUPPLIES

LRS-55 SERIES

This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics. All information contained herein applies to all LRS-55 models unless otherwise specified.

LAMBDA ELECTRONICS MELVILLE, L I , N Y.

MAIN PLANT TELEPHONE (516) 694-4200

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SPECIFICATIONS AND FEATURES

DC OUTPUT — Voltage regulated for line and load. See table I for voltage and current ratings.

TABLE I
VOLTAGE AND CURRENT RANGES

MODELS	VOLTAGE RANGE	MAXIMIM CURRENT (AMPS) AT AMBIENT TEMPERATURE				INPUT POWER*
		40°C	50°C	60°C	71°C	
LRS-55-2	2 ± 5%	60A	51A	41A	30A	210W.
LRS-55-5	5 ± 5%	60A	51A	41A	30A	420W.
LRS-55-6	6 ± 5%	52	44	36	26	437W.
LRS-55-12	12 ± 5%	30	26	22	16	491W.
LRS-55-15	15 ± 5%	25	22	19	13	511W.
LRS-55-20	20 ± 5%	19	16.5	14	10	500W.
LRS-55-24	24 ± 5%	16	14	12	8	505W.
LRS-55-28	28 ± 5%	14	12	10	7	515W.
LRS-55-48	48 ± 5%	8.2	7.2	6.2	4.2	517W.

*With output loaded to full current rating and input voltage at 95 V AC.

Current range must be chosen to suit the appropriate maximum ambient temperature. Current ratings apply for entire voltage range

REGULATED VOLTAGE OUTPUT

Regulation..... 0.1% line or load with input variations from 95-132 or 132-95 volts AC and load variations from no load to full load.

Ripple and Noise.....10mV RMS, 35m V peak-to-peak for LRS-55-2, 5 and 6 volt models; 15mV RMS. 100m V peak-to-peak for LRS-55-12 thru LRS-55-28; 35m V RMS, 150m V p-p for LRS-55-48, with either positive or negative terminal grounded.

Temperature Coefficient .....Change in output voltage 0.03%/°C max.

Remote Programming

External Resistor. ....Nominal 1000 ohms/volt output.

Programming Voltage .. . . . . One-to-one voltage change

Remote Sensing. . . . . Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

Remote On/Off Control . . . . . The DC output may be turned on and off remotely by means of digital command. (See page 6).

HOLD-UP Time. . . . . 2V, 5V and 6V models will remain within regulation limits for at least 16.7 msec, after loss of AC power, when operating at full load, maximum output voltage and 105 VAC input at 60 Hz.

OVERSHOOT — No overshoot under conditions of power turn-on, turn-off, or power failure.

INPUT

AC Input. . . . . 95-132 VAC at 47-440 Hz. Input power: 517W max*. Input Current: 12.0A max*. For operation at frequencies above 440 Hz, consult factory. Where applicable, regulatory agency approval applies only for input frequencies in the range 47-63 Hz. Leakage current in the ground connection may exceed the limits allowed by these agencies at frequencies above this range.

*With output loaded to full current rating and input voltage 95 VAC, 60 Hz.

DC Input. . . . . 145 VDC ±10%. Input current: 3.8† Amperes.

†With output loaded to full current rating and input voltage 130 VDC.

SOFT START — The turn-on inrush current will not exceed 40 amps.

INPUT FUSE — Fuse F1 protects the input wiring to the power supply. Overload of power supply does *not* cause fuse failure.

OVERLOAD PROTECTION

Thermal. . . . . Thermostat resets automatically when overtemperature condition is eliminated.

Electrical. . . . . Automatic electronic current limiting circuit, limits output current to a preset safe value. Automatic current limiting protects the load and power supply when external overloads and direct shorts occur.

OVERVOLTAGE PROTECTION — All LRS-55 models include fixed non-crowbar built-in overvoltage protection circuits which prevent damage to the load caused by excessive power supply output voltage. See table on the following page for overvoltage protector firing ranges.

MODEL	OVERVOLTAGE PROTECTOR MAXIMUM TRIP POINT
LRS-55-2	4.2V
LRS-55-5	6.8V
LRS-55-6	7.5V
LRS-55-12	14.9V
LRS-55-15	19 0V
LRS-55-20	26.1V
LRS-55-24	31.2V
LRS-55-28	36.3V
LRS-55-48	59.8V

INPUT CONNECTIONS — Terminal block on front of chassis.

OUTPUT CONNECTIONS — 10/32 Threaded bus bars.

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE — Continuous duty from -10°C to 71°C ambient with corresponding load current ratings for all modes of operation.

STORAGE TEMPERATURE (non-operating) — -55°C to 85°C

FUNGUS — All LRS-55 power supplies are fungus inert.

VDC ADJ. Control — 10-Turn voltage adjust control permits adjustment of DC output over entire operating range.

PHYSICAL DATA

Size .....3-3/4" x 4-7/8" x 10-1/2"
Weight .....8 1/2 lbs. net; 10 lbs. shipping
Finish .....Grey, FED. STD. 595 No. 26081

MOUNTING — One mounting surface and one mounting position.

ACCESSORIES

Rack adapters .....Rack adapters LRA-15, and LRA-17, used for ruggedized mounting with or without chassis slides, are available.

THEORY OF OPERATION

GENERAL

The LRS-55 Series consists of the following circuit elements

Input Circuit

Pulse Width Modulated Inverter

Auxiliary Rectifier And Filter

Output Rectifier And Filter

Regulator Control Integrated Circuit, consisting of a timing oscillator, pulse width modulator, output drive, undervoltage detect and shutdown, current limit and frequency shift.

FUNCTIONAL DESCRIPTION

Input Circuit

Since phase AC input power is applied to diode bridge circuit CR201-CR204 through EMI suppression chokes L201 and L202. Fuse F201 protects the power supply against excessive currents due to internal failures

The input bridge and filter capacitors C201, C202 provide power to the power MOSFET switch and provide power via R101, C101 and CR101 to the regulator control integrated circuit, IC101. At turn-on C201, C202 charges through inrush current limiting resistor R203. When the AC input reaches approximately 95 VAC, the U.V. detect circuit will enable control IC101 to supply pulse width modulated drive to the power MOSFET switch, Q101 As the power MOSFET switch begins to conduct, the voltage on gate capacitor C218 will rise until SCR201 conducts and shorts out R203 thus completing the inrush current limiting cycle.

Pulse Width Modulated Inverter

The inverter is a single-ended configuration using a power MOSFET switch, Q101. During the "on" time, a positive pulse is delivered to the gate of the power switch from integrated circuit controller IC101, pin 8, via C115 A positive pulse turns Q101 "on". During "off" time pin 8 shorts Q101 gate to C101( ) and turns Q101 off. Switching action of Q101 delivers positive and negative pulses to T1 primary

Output Rectifier And Filter

The transistor "on" time primary pulse produces a positive secondary pulse which causes CR1A to conduct and deliver current to the load Because output current is returned to T1 secondary through filter choke L1, energy is stored in L1 during Q101 "on" time The Q101 "off" time primary pulse produces a negative secondary pulse which causes CR1A to turn off and CR1B to turn on. Energy stored in L1 is then delivered to the load through CR1B during Q101 "off" time. Output ripple attenuation is accomplished via the dual LC filter L1, L205, C208 and C209 Capacitors C206, C207, C203, C204, C205 and C220 furnish additional output noise suppression.

Regulator Control IC101

Timing oscillator section

IC101 pins 11, 12 and 13, R110 and R111 work in conjunction with C106 to set the main oscillator frequency, 50 khz, and the maximum duty ratio, $T_{on}/(T_{on} + T_{off})$ R110, C106 set maximum "on" time T_{on}, R111, C106 set maximum "off" time T_{off}

Pulse width modulator section

Pulse width modulation, necessary to control the output voltage, is determined by the feed-forward comparator Changes in the output are sensed and divided down by R128 and R129. This signal is fed into the reference of IC103 IC103 controls the current through optical coupler diode OC101, which is optically coupled to the base of OC101 internal transistor. Collector voltage of OC101 transistor is fed into IC101 pin 18. This voltage, when compared to a ramp signal developed by C105 by R109 and R135, sets the pulse width of the output drive through IC101 pin 8, as required to maintain the desired output voltage The ramp on C105 is automatically reset each switching cycle by IC101 The slope of the ramp is proportional to the voltage across input capacitors C201 and C202.

Undervoltage detect; shutdown

Low input line detect comparator, IC101 pins 3 and 4, monitors changes in the input line. If the input line falls below approximately 95 VAC, the output drive will be inhibited.

At power up, C104, connected at IC101 pin 4, provides a delay before inverter operation to eliminate any secondary input inrush currents At power down, C104 provides a delay at the undervoltage circuit to allow for hold-up time, where required

Current limit and frequency shift

Current limit comparator IC101, pins 16 and 17, provide pulse termination current limit When output current exceeds the preset safe value, the current-limit comparator disables the output drive, which remains disabled until the end of the switching cycle

In order to maintain the foldback characteristic when both output voltage and current are decreasing, the comparator will parallel C107 with timer capacitor C106 increasing the discharge-time of C106. This increased discharge-time constant causes the operating frequency to decrease allowing a decreasing output current as the output voltage decreases. All LRS-55 units are designed with a current limit characteristic which presents constant current limiting from nominal output down to approximately 70% of Vo(nom) They then foldback to a current of approximately 70% full load at short circuit

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 40°C. For continuous operation, load current must not exceed the rating for each ambient temperature. When rated load current is exceeded, voltage decreases towards zero and the current at short circuit is held to a safe value

CONNECTIONS FOR OPERATION

NOTE Make all connections to the unit before applying input power

Ground Connections. The supply can be operated either with negative or positive output terminal grounded. Both positive and negative ground connections are shown in the diagrams for all suggested output connections illustrated in this manual.

Connection Terminals Make all connections to the supply at the terminal blocks and bus bars on the front of the supply Apply input power to terminals 1 and 2, always connect the ungrounded (hot) AC or positive DC lead to terminal 1

The supply positive terminal is brought out to terminal 6 The supply negative terminal is brought out to terminal 4 Recommended wiring of the power supply to the load and selection of wiring is shown in figures 1 through 10 Selection of proper wiring is made on the basis of load requirements Make all performance checks and measurements of current or voltage at the front output terminals Connect measuring devices directly to terminals or use the shortest leads possible

Remote Turn-on/Turn-off Make connections to Isolated pins 8 (+) and 9 (-), see figure 8

Turn-off Apply 2 8 → 5V (TTL "1") at terminals 8 and 9 observing polarity shown. There is an internal 1 KΩ limiting resistor in series with pin 8, causing approximately 2 8 → 5ma to be drawn from the TTL source

Turn on Apply 0 → 0 4V (TTL "0") or open circuit at terminals 8 and 9

SUPPLY LOAD CONNECTIONS

Connections for Operation as a Constant Voltage Source

The output impedance and regulation of the power supply at the load may change when using the supply as a constant voltage source and connecting leads of practical length are used To minimize the effect of the output leads on these characteristics, remote sensing is used Recommended types of supply load connections with local or remote sensing are described in the following paragraphs

Refer to figure 1 to determine voltage drop for particular cable length, wire size and current conditions Lead lengths must be measured from supply terminals to load terminals as shown in figure 2

Local Sensing Connection, Figure 3 Local sensing is the connection suitable for applications with relatively constant load or for applications with short power output leads

Remote Sensing Connection, Figure 4 Remote sensing provides complete compensation for the DC voltage drops in the connecting cables. Sensing leads should be a twisted pair to minimize AC pick-up. A 2 5 mf elect , capacitor may be required between output terminals and sense terminals to reduce noise pick-up

Programmed Voltage Connections, Using External Resistor, Figure 5. Discrete voltage steps can be programmed with a resistance voltage divider valued at a nominal 1000 ohms/volt change and a shorting-type switch as shown in figure 5 When continuous voltage variations are required, use a variable resistor with the same 1000 ohms/volt ratio in place of the resistive voltage divider and shorting-type switch Use a low temperature coefficient resistor to assure most stable operation.

Before programming, adjust programming resistor for zero resistance and set voltage adjust control to the minimum rated output voltage Output voltage of programmed supply will nominally be minimum output voltage plus 1 volt per 1000 ohms

As shown in figure 5, voltages can be programmed utilizing either local or remote sensing connections, as desired.

Programmed Voltage Connections Using Programming Voltage, Figure 6 The power supply voltage output can be programmed with an externally connected programming power supply. The output voltage change of the programmed supply will maintain a one-to-one ratio with the voltage of the programming supply. If the output voltage control of the programmed supply is set to minimum output voltage, output voltage of the programmed supply will be minimum output voltage plus voltage of programming supply

The programming supply must have a reverse current capability of 1 ma minimum

Alternatively, when supplies with less than 1 ma reverse current capability are used, a resistor capable of drawing 1 ma at the minimum programming voltage must be connected across the output terminals of the programming supply This programming supply must be rated to handle all excess resistor current at the maximum programming voltage

Connections For Series Operation, Figure 7.

The voltage capability of LRS-55 power supplies can be extended by series operation. Figure 7 shows the connections for either local or remote sensing in a series connection where the voltage control of each unit functions independently to control the output.

A diode, having a current carrying capability equal to or greater than the maximum current rating of the supply, must be used and connected as shown in figure 7 The diode blocking voltage should be at least twice the maximum rated output voltage of the supply See table I, of SPECIFICATIONS AND FEATURES, for power supply current and voltage ratings

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Thermostat Shutdown. The thermostat shuts down inverter operation only when the temperature of the MOSFET switch heat radiator exceeds a maximum safety value The thermostat will automatically reset when the temperature of the heat sink decreases to a safe operating value.

Fuse Shutdown. Fuse will blow when the maximum rated current value for the fuse is exceeded. Fatigue failure of fuses can occur when mechanical vibrations from the installation combine with thermally induced stresses to weaken the fuse metal. Many fuse failures are caused by a temporary condition and replacing the blown fuse will make the fuse protected circuit operative.

Overvoltage Shutdown When the power supply output voltage increases above the overvoltage limit, the non-crowbar overvoltage circuit will shut down inverter operation. After eliminating the cause(s) for overvoltage, resume operation of the supply by interrupting the AC input circuit for a period of sixty seconds

MAINTENANCE

GENERAL

This section describes calibration and test procedures that are useful for servicing the Lambda power supply

OPENING UNIT FOR TROUBLESHOOTING AND REPAIR

Whenever it is necessary to troubleshoot and repair the Lambda LRS-55 power supply, open the unit as follows

1 Separate upper and lower enclosures by removing (5) 6-32 screws, see outline drawing, figure 10.

2 With unit resting on its 3.75" x 10 5" mounting surface, allow lower enclosure to drop down with PC board component side facing upward

3 Power supply components are now accessible for troubleshooting and repair

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check all fuses, primary power lines, external circuit elements, and external wiring for malfunction before troubleshooting the equipment. Failures and malfunctions often can be traced to simple causes such as improper jumpers and supply-load connections or fuse failure due to metal fatigue.

Use the electrical schematic diagram and block diagram, figure 9, as an aid to locating trouble causes. The schematic diagram contains various circuit voltages that are averages for normal no load operation. Measure these voltages using the conditions for measurement specified on the schematic diagram. Use measuring probes carefully to avoid causing short circuits and damaging circuit components.

CHECKING CAPACITORS

The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor *In all cases the capacitors are shunted with resistances,* some of which have low values Only a dead short is a true indication of a shorted capacitor.

PRINTED CIRCUIT BOARD MAINTENANCE TECHNIQUES

1. If foil is intact, but not covered with solder, it is a good contact. Do not attempt to cover with solder

2 Voltage measurements can be made from either side of the board Use a needle-point probe to penetrate to the wiring whenever a protective coating is used on the wiring A brass probe can be soldered to an alligator clip adapted to measuring instrument

3 Always use a heat sink when soldering transistors, a transistor pad with mounting feet is an effective heat sink

4 Broken or damaged printed wiring is usually the result of an imperfection, strain or careless soldering To repair small breaks, tin a short piece of hook up wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry

5 When unsoldering components from the board never pry or force loose the part, unsolder the component by using the wicking process described below

a) Select a 3/16 inch tinned copper braid for use as a wick, if braid is not available, select AWG No 14 or No 16 stranded wire with 1/2 inch insulation removed

b) Dip the wick in liquid rosin flux

c) Place the wick onto the soldered connection and apply soldering iron onto the wick

d) When sufficient amount of solder flows onto the wick, freeing the component, simultaneously remove iron and wick

PERFORMANCE CHECKS

Check the ripple and regulation of the power supply using the test connection diagram shown in figure 10 Use suggested test equipment or equivalent to obtain accurate results Refer to SPECIFICATIONS AND FEATURES for minimum performance standards

Set the differential meter, DC DVM (John Fluke Model 891A or equivalent) to the selected power supply operating voltage Check the power supply load regulation accuracy while switching from the no load to load condition Long load leads should be a twisted pair to minimize AC pick-up

Use a Variac to vary the line voltage from 95-132 or 132-95 volts AC and check the power supply line regulation accuracy on the DVM differential meter.

Use a TVM, John Fluke Model 931B or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak-to-peak ripple voltage of the power supply DC output

ADJUSTMENT OF CURRENT LIMIT CALIBRATION CONTROL R116

Whenever IC101, T101, CR104 or R117 are replaced, and voltage and current indications do not reflect maximum ratings, adjust R116 as follows The adjustment procedure requires that the power supply is removed from associated equipment, is at an ambient temperature of 25-30°C, and is stabilized and not operating

1 Remove AC power to the supply

2 Break seal on wiper of R116 from resistor housing and turn to midrange position

3. Operate power supply for constant voltage with local sensing connected as shown in figure 3, with no external load, and with AC input of 132 VAC, 60 Hz

4 Turn voltage adjust control until maximum rated output voltage is obtained

5 Apply load so that output current is 105% of 40°C rating for the unit If output voltage drops, Adjust R116 to allow V_{out} max at 105% of 40°C rating

6. Using an oscilloscope, Tektronix 503 or equivalent, observe output voltage while adjusting R116 in CCW direction Adjust R116 until output ripple increases sharply and output voltage begins to decrease

7 After adjustment is completed, remove AC power input to the supply and use glyptol sealant to seal wiper of R116 to resistor housing

8 After sealing, check setting and repeat adjustment procedure if required.

ADJUSTMENT OF FEED FORWARD CONTROL R135

Whenever IC101 is replaced it may be necessary to readjust R135 as follows The adjustment procedure requires that the power supply is removed from associated equipment, is at an ambient temperature of 25-30°C, and is stabilized and not operating

1 Remove AC input power to the supply

2 Break seal on wiper of R135 from resistor housing and turn to midrange position

3 Adjust R116 fully CW

4 Operate power supply for constant voltage with local sense connected as shown in figure 3 Apply external resistive load equal to the 40°C current rating, with voltage input of 115 VAC at 60 Hz.

5 Remove AC input power to the supply and open the positive sense connection While monitoring output voltage, reapply AC input power

6 Adjust R135 until output voltage reaches 110% of the maximum output voltage rating To increase output voltage turn R135 CW, to decrease output voltage turn R135 CCW.

7 After adjustment is completed, remove AC power input to the supply and use glyptol sealant to seal wiper of R135 to resistor housing Reconnect positive sense connection

8 Readjust R116, refer to ADJUSTMENT OF CALIBRATION CONTROL R116

SERVICE

When additional instructions are required or repair service is desired, contact the nearest Lambda office where trained personnel and complete facilities are ready to assist you

Please include the power supply model and serial number together with complete details of the problem On receipt of this information, Lambda will supply service data or advise shipping for factory repair service

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started

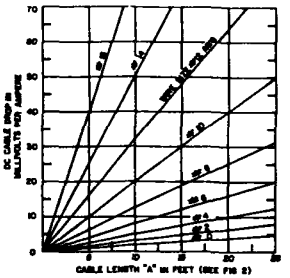


Figure 1. Cable Connection Chart.

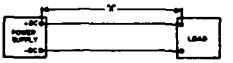
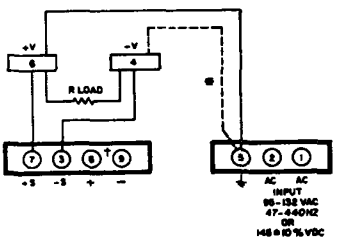
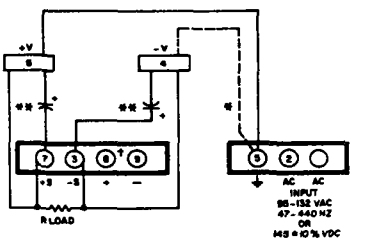


Figure 2 Cable Length "A" in Feet



NOTE
@ FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 5 AND 6 AND RECONNECT TO TERMINALS 5 AND 4
† REMOTE ON/OFF TERMINALS

Figure 3 Local Sensing Connections



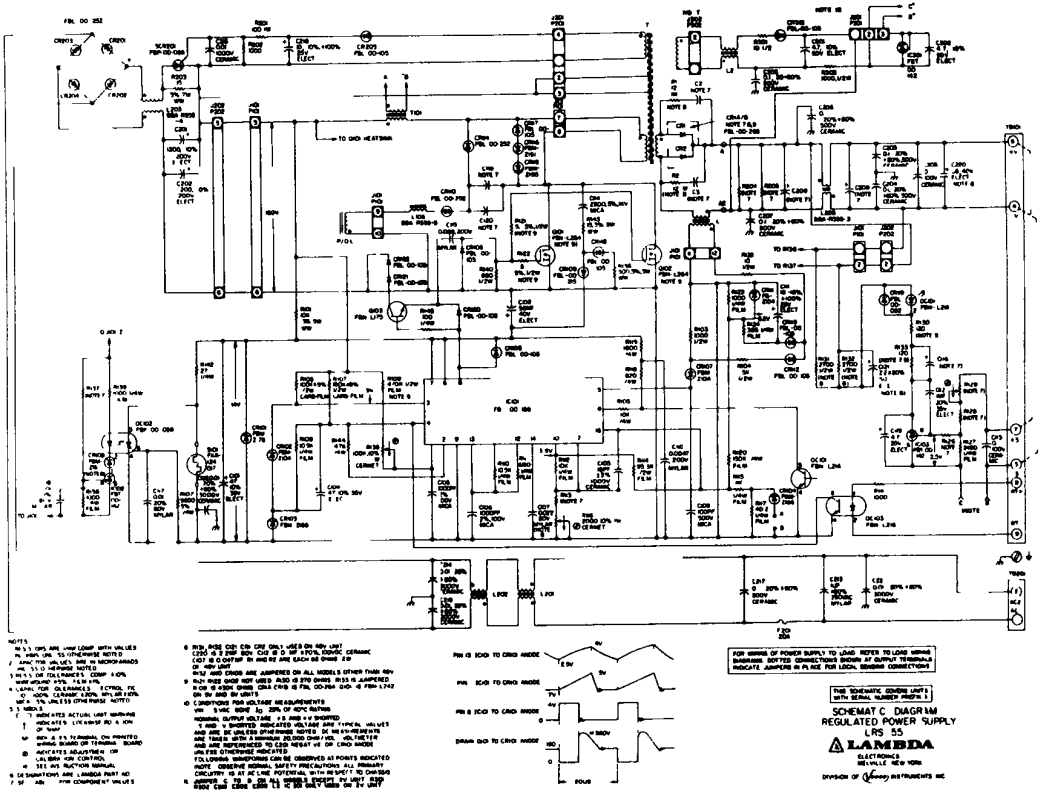
NOTE
@ FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS 5 AND 6 AND RECONNECT TO TERMINALS 5 AND 4
R@ 4.5 Ω 5W, ELECT CAP MAY BE REQUIRED
† REMOTE ON/OFF TERMINALS

Figure 4 Remote Sensing Connections.

SCHEMATIC DATA REFERENCES MODELS LRS-55 2 LRS-55-48

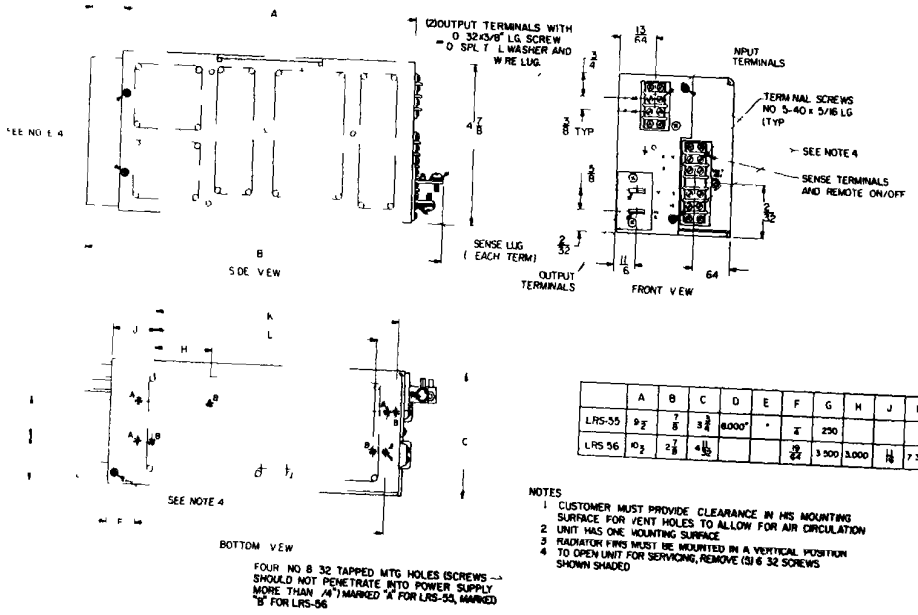
MODELS	Schematic Components											
	C2, C3	C116	C118, C120	C208, C209	CR1A, CR1B	R126	R128	R129	R133	R137	R204, R205	R113
	±10% 3,000 vdc CERAMIC	±20% 35 vdc ELECT	±5% 1,000 vdc MICA	10 +75% ELECT	*FBL 00	±10% 1/4W COMP	±1% 1/4W FILM	±10% 3/4W VAR CERMET	±10% 1/4W COMP	±1% 1/4W FILM	±10% 1W COMP	±1% 1/4W FILM
LRS 55 2	NOT USED	NOT USED	4,700 pf	18,000 mf 7.5 vdc	264	6.8K	1,620	2,000	JUMPER	619	47	3.48K
LRS 55 5	NOT USED	NOT USED	4,700 pf	18,000 mf 7.5 vdc	264	6.8K	2,000 ±2%	2,000	JUMPER	1,620 1/2W	47	3.48K
LRS 55-6	NOT USED	NOT USED	4,700 pf	18,000 mf 7.5 vdc	264	6.8K	2,000 ±2%	5,000	JUMPER	2,000 ±2%	100	3.48K
LRS 55 12	.002	.47 mf ±20% 50 vdc CERAMIC	4,700 pf	10,000 mf 20 vdc	265	10K	7,500	5,000	270	4,700 ±2%	330	3.48K
LRS 55 15	001	.47 mf ±20% 50 vdc CERAMIC	4,700 pf	10,000 mf 20 vdc	265	10K	10K	5,000	270	6,340	560	4.32K
LRS-55 20	.001	1 mf	4,700 pf	5,800 mf 35 vdc	265	10K	15K	5,000	120	9.09K	820	4.32K
LRS-55-24	.002	1 mf	3,600 pf	5,800 mf 35 vdc	265	10K	18.2K	10K	120	11K	1,000	4.32K
LRS-55 28	.001	1 mf	3,600 pf	5,800 mf 35 vdc	265	10K	22K	10K	120	13K	1,500	4.1K
LRS-55 48	.0010	NOT USED	3,600 pf	2,300 mf 60 vdc	NOT USED	1,000	40.2K	20K	120	22K	5,600	30.1

*Lambda Part No.



SCHEMATIC DIAGRAM
REGULATED POWER SUPPLY
LRS 55

LAMBDA
ELECTRONICS
MELVILLE NEW YORK
DIVISION OF Kenney INSTRUMENTS INC



	A	B	C	D	E	F	G	H	J	K	L
LRS-35	9			6.000"	•		250				
LRS 56	10	2	4				3.500	3.000		7.343	7.25

NOTES
1. CUSTOMER MUST PROVIDE CLEARANCE IN HIS MOUNTING SURFACE FOR VENT HOLES TO ALLOW FOR AIR CIRCULATION
2. UNIT HAS ONE MOUNTING SURFACE
3. RADIATOR FINS MUST BE MOUNTED IN A VERTICAL POSITION
4. TO OPEN UNIT FOR SERVICING, REMOVE (5) 6 32 SCREWS SHOWN SHADED

Outline Drawing

INSTRUCTION MANUAL

FOR

REGULATED POWER SUPPLIES

LRS-52M SERIES

This manual provides instructions intended for the operation of Lambda power supplies and is not to be reproduced without the written consent of Lambda Electronics All information contained herein applies to all -LRS-52M models unless otherwise specified

LAMBDA ELECTRONICS MELVILLE L I N Y

MAIN PLANT TELEPHONE 516-694-4200

2 87

IM LRS 52M

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SPECIFICATIONS AND FEATURES

DC OUTPUT Voltage regulated for line and load See Table I for voltage and current ratings

TABLE I

MODELS	VOLTAGE RANGE	MAXIMUM CURRENT (AMPS)* AT AMBIENT TEMPERATURE				INPUT POWER (WATTS)**
		40°C	50°C	60°C	71°C	
LRS-52M-2	2±5%	15	13 7	11 1	5 9	65
LRS-52M-5	5±5%	15	13 7	11 1	5 9	118
LRS-52M-6	6+5%	13 5	12 2	9 9	5 2	127
LRS-52M-12	12+5%	7 8	6 8	4 9	2 3	131
LRS-52M-15	15±5%	6 4	5 6	4	1 9	135
LRS-52M-20	20±5%	4 9	4 3	3	1 5	137
LRS-52M-24	24+5%	4 1	3 6	2 6	1 2	132
LRS-52M-28	28+5%	3 5	3 1	2 2	1 1	132
LRS-52M-48	48+5%	2 0	1 7	1 2	0 6	130

Current range must be chosen to suit the appropriate maximum ambient temperature Current ratings apply for entire voltage range

* Ratings apply for use with cover

**With output loaded to full current rating

REGULATED VOLTAGE OUTPUT

Regulation	0 1% line or load with input variations between 85-132 or 170-265 volts AC and load variations from no load to full load
Ripple and Noise	10mV RMS, 25mV p-p for 2V models 10mV RMS, 35mV p-p for 5V and 6V models 15mV RMS, 100mV p-p for 12V thru 28V Models 35mV RMS, 150mV p-p for 48V models
Temperature Coefficient	0 03%/°C
Remote Programming	
External Resistor	Nominal 1000 ohms/volt output
Programming Voltage	One-to-one voltage change
Remote Sensing	*Provision is made for remote sensing to eliminate effect of* power output lead resistance on DC regulation
Remote on-off control	The DC output of all LRS-52M power supplies can be turned *on and off remotely by means of digital command* Turn-off Apply 2 8 5V (TTL " ") at 5 mA min to terminals R+ and R Up to 35 mA max can be applied to terminals R+ and R without damaging power supply Turn-on Apply 0 0 4V (TTL "0") or open circuit at terminals R+ and R

OVERSHOOT No overshoot under conditions of power turn-on turn-off, or power failure

INPUT

AC INPUT 85 to 132 volts AC at 47 to 440 Hz, or 170 to 265 VAC at 47 to 440 Hz via field selectable jumper (When shipped from factory, all LRS-52M power supplies are wired for 170 to 265 VAC input. To configure for 85 to 132 VAC input, connect jumper between P C Board terminals 'A' and 'B'). Where applicable regulatory agency approval applies only for input voltages up to 250 VAC and for input frequencies in the range 47-63 Hz Leakage current in the ground connection may exceed the limits allowed by these agencies at frequencies above this range For North American application, apply AC input to terminals marked AC L & N

Input power . . .. 130 Watt Max * Input current 2 2 ampers RMS**

* With output loaded to full current rating and maximum output voltage

** With output loaded to full current rating and input voltage 85 VAC, 60 Hz

DC Input .. .. 260-370 VDC Regulatory agency approval applies only for input voltages up to 350 VDC Power supply must be connected in 220 VAC configuration Input current 1.1 Amps.

† With output loaded to full current rating and input voltage 260 VDC

SOFT START CIRCUIT . . . . . Limits in rush current at turn-on to 50 A max

OVERLOAD PROTECTION

Thermal	Thermostat, resets automatically when over temperature condition is eliminated
Electrical External	External overload protection, automatic electronic current limiting circuit limits the output current to a preset value, thereby providing protection for the load as well as the power supply The current limit characteristic exhibits a region of relatively constant current behavior followed by a foldback region
Internal	Line fuse removes the power supply from the line if a short occurs in the input circuitry

OVERVOLTAGE PROTECTION ALL LRS-52M models include fixed built-in overvoltage protection circuits which prevent damage to the load caused by excessive power supply output voltage If output voltage increases above a preset level, inverter drive is removed See Table II for overvoltage trip-point range

TABLE II

MODEL	OVERVOLTAGE PROTECTOR TRIP-POINT RANGE (VOLTS)
LRS-52M 2	3 2 3 8
LRS-52M 5	6 4 6 8
LRS-52M-6	7 1 7 5
LRS-52M-12	13.3 14 9
LRS-52M-15	16 5 19 0
LRS-52M-20	22 1 26 1
LRS-52M-24	26 5 29 9
LRS-52M 28	31 0 36 3
LRS-52M-48	53 0 59 8

INPUT AND OUTPUT CONNECTIONS Refer to Figure 11 for location

TERMINAL BLOCK IN FRONT OF CHASSIS

HOLD-UP TIME 20 ms at 105 VAC 60Hz or 210 VAC 50Hz

POWER FAILURE

2 5 and 6 volt models will remain within regulation limits for at least 20msec after loss of AC power when operating a full load, Vo max and 105 or 210V AC input at 60 or 50 Hz

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE Continuous duty 10°C to 71°C with suitable derating above 40°C Unit will start up at 20°C but may not meet published specs until internal heating raises the temperature to 10°C

STORAGE TEMPERATURE (non operating) 55°C +85°C

FUNGUS ALL LRS -52M power supplies are Fungus inert

DC OUTPUT CONTROL Screwdriver voltage adjust control permits adjustment of DC output voltage Refer to Figure 1 for location of control

PHYSICAL DATA

Size	2" x 4 7/8" x 6 1/4"
Weight	2 6 lbs net, 3 5 lbs shipping
Finish	Gray FED STD 595 No 2608

MOUNTING Two mounting surfaces and two mounting positions, Refer to Figure 11 for mounting details

COOLING Unit is convection cooled No fans or blowers required

ACCESSORIES Rack adapter available (LRA 15, LRA 17) Cable system available

WARRANTY 5 years warranty from date of shipment, materials and labour

SAFETY AGENCY APPROVAL

UL	Designed for listing in the UL recognized component index per UL 478
CSA	Designed for CSA certification per CSA C22 2 numbers 143 and 154
VDE/IEC	Designed for compliance with VDE 0806 and IEC 435/380 (class 1, non selv)

SPECIFICATIONS Shock/Vibration/Temperature

LRS series will be designed to pass the following tests in accordance with MIL STD 810C

Low Pressure	Method 500 1 Procedure I
High Temperature	Method 501 1, Procedures and II
Low Temperature	Method 502 1, Procedure I
Temperature Shock	Method 503 1, Procedure I
Temperature Altitude	Method 504 1 Procedure I Class 2 (10°C operating)
Humidity	Method 507 1, Procedure I
Fungus	Method 508 1, Procedure I
Vibration	Method 514 2, Procedures X and XI
Shock	Method 516 2, Procedures I and III
EMI AND RFI	Conducted emissions conforms to VDE 0871 class A
	FCC Docket 20780 class A
	MIL STD–461A Notice 4 CE04 for power leads

OPERATING INSTRUCTIONS

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 40°C For continuous operation, load current must not exceed the rating for each ambient temperature When load exceeds 105% of 40°C rating, the voltage decreases towards zero while the current is held Upon removal of overload, normal operation resumes

CONNECTIONS FOR OPERATION

NOTE Make all connections to unit before applying AC input power

Ground Connections. The Lambda power supply can be operated either with negative or positive output terminal grounded Both positive and negative ground connections are shown for all suggested output connections illustrated in this manual

Connection Terminals Make all connections to the supply at the terminals provided Apply input power to AC terminals, always connect the ungrounded (hot) lead to terminal indicated in Figures 3 through 7

The supply positive terminal is brought out to +V The supply negative terminal is brought out to V Recommended wiring of the power supply to the load and selection of wiring is shown in Figures 1 through 7 Selection of proper wiring is made on the basis of load requirements Make all performance checks and measurements of current or voltage at the output terminals Connect measuring devices directly to terminals or use the shortest leads possible

Remote Turn on/Turn-off Make connections to Isolated pins R(+) and R( ), see Figure 8

Turn-off Apply 2 8 ÷ 5V (TTL "1") min at terminals R(+) and (R( ) observing polarity shown There is an internal 1 KΩ limiting resistor in series with pin 8, causing approximately 2 5 ÷ 5ma to be drawn from the TTL source

Turn on Apply 0 ÷ 0 4V (TTL "0") or open circuit at terminals R(+) and R( )

SUPPLY LOAD CONNECTIONS

Connections for Operation as a Constant Voltage Source

The output impedance and regulation of the power supply at the load may change when using the supply as a constant voltage source and connecting leads of practical length are used To minimize the effect of the output leads on these characteristics, remote sensing is used Recommended types of supply load connections with local or remote sensing are described in the following paragraphs

Refer to Figure 1 to determine voltage drop for particular cable length, wire size and current conditions Lead lengths must be measured from supply terminals to load terminals as shown in Figure 2

Local Sensing Connections, Figure 3 Local sensing is the connection suitable for applications with relatively constant load or for applications with short power output leads

Remote Sensing Connections, Figure 4 Remote sensing provides complete compensation for the DC voltage drops in the connecting cables Sensing leads should be a twisted pair to minimize AC pick-up A 2 5 mf, electrolytic capacitor may be required between output terminals and sense terminals to reduce noise pick-up

Programmed Voltage Connections, Using External Resistor, Figure 5 Discrete voltage steps can be programmed with a resistance voltage divider valued at 1000 ohms/volt change and shorting-type switch as shown in Figure 5 When continuous voltage variations are required, use a variable resistor with the same 1000 ohms/volt ratio in place of the resistive voltage divider and shorting-type switch Use a low temperature coefficient resistor to assure most stable operation

Before programming, adjust programming resistor for zero resistance and set voltage adjust control to the minimum rated output voltage Output voltage programmed supply will be minimum output voltage plus 1 volt per 1000 ohms

As shown in Figure 5, voltages can be programmed utilizing either local or remote sensing connections as desired

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Thermostat Shutdown

The thermostat opens the input circuit only when the temperature of the internal heat sink exceeds a maximum safe value. The thermostat will automatically reset when the temperature of the heat sink decreases to a safe operating value. After eliminating cause(s) for overheating and allowing time for the power supply to cool to a proper temperature, resume operation of the supply.

Fuse Shutdown

Fuses will blow when the maximum rated current value for the fuse is exceeded. Fatigue failure of fuses can occur when mechanical vibrations from the installation combine with thermally induced stresses to weaken the fuse metal. Many fuse failures are caused by a temporary condition and replacing the blown fuse will make the fuse protected circuit operative.

Overvoltage Shutdown. When the power supply output voltage increases above the overvoltage limit, the overvoltage protection circuit will shut down inverter operation. After eliminating the cause(s) for overvoltage, resume operation of the supply by interrupting the AC input circuit for at least 30 sec.

MAINTENANCE

GENERAL

This section describes trouble analysis routine, calibration and test procedures that are useful for servic ng the Lambda power supply Refer to the sect on on SPECIFICATIONS AND FEATURES for the minimum performance standards

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check all fuses primary power lines, external circuit elements and external wiring for malfunction before troubleshooting the equipment Failures and malfunctions often can be traced to simple causes such as improper jumpers and supply load connections or fuse failure due to metal fatigue

Use the electrical schematic diagram and block diagram, Figure 8, as an aid to locating trouble causes The schematic diagram contains various circuit voltages that are averages for normal no load operation Measure these voltages using the conditions for measurement specified on the schematic diagram Use measuring probes carefully to avoid causing short circuits and damaging circuit components

CHECKING FET AND CAPACITORS

Check the fet in circuit with an ohmmeter, taking in account the gate protection zener diode (source to gate) and the built-in diode from source to drain

Do not assume trouble is eliminated when only one part is replaced This is especially true when one fet fails, causing other parts to fail Replacing only one transistor and turning power on, before checking for additional faulty components,could damage the replaced compo ent

When soldering semi-conductor devices, hold the lead being soldered with a pair of pliers or a com mercial heat sink device placed between the component and the solder joint

NOTE. The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor In all cases the capacitors are shunted with resistances, some of which have low values Only a dead short is a true indication of a shorted capacitor

PRINTED CIRCUIT BOARD MAINTENANCE TECHNIQUES

1 If foil is intact, but not covered with solder, it is a good contact Do not attempt to cover with solder

2 Voltage measurements can be made from either side of the board Use a needle point probe to pene trate to the wiring whenever a protective coating is used on the wiring A brass probe can be soldered to an alligator clip adapted to measuring instrument

3 Always use a heat sink when soldering transistors a transistor pad with mounting feet is an effective heat sink

4 Broken or damaged printed wiring is usually the result of an imperfection, strain or careless soldering To repair small breaks, tin a short piece of hook-up wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry

5 When unsoldering components from the board,never pry or force loose the part Unsolder the com ponent by using the wicking process described below

   a) Select 3/16 inch tinned copper braid for use as a wick, if braid is not available, select AWG No 14 or No 16 stranded wire with 1/2 inch insulation removed

   b) Dip the wick in liquid rosin flux

c) Place the wick onto the soldered connection and apply soldering iron onto the wick

d) When sufficient amount of solder flows onto the wick, freeing the component, simultaneously remove iron and wick

PERFORMANCE CHECKS

Check the ripple and regulation of the power supply using the test connection diagram shown in Figure 9. Use suggested test equipment or equivalent to obtain accurate results. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Set the differential meter, DC DVM (John Fluke Model 891A or equivalent) to the selected power supply operating voltage. Check the power supply load regulation accuracy while switching from the no load to load condition. Long load leads should be a twisted pair to minimize AC pick-up.

Use a Variac to vary the line voltage from 85-132 or 170-265 volts AC and check the power supply line regulation accuracy on the DVM differential meter.

Use a VTVM, John Fluke Model 931B or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak to peak ripple voltage of the power supply DC output.

ADJUSTMENT OF CALIBRATION CONTROLS

Whenever voltage and current indications do not reflect maximum ratings, adjust R114 as follows. The adjustment procedure requires that the power supply is removed from associated equipment, is at an ambient temperature of 25-30°C and is stabilized and not operating.

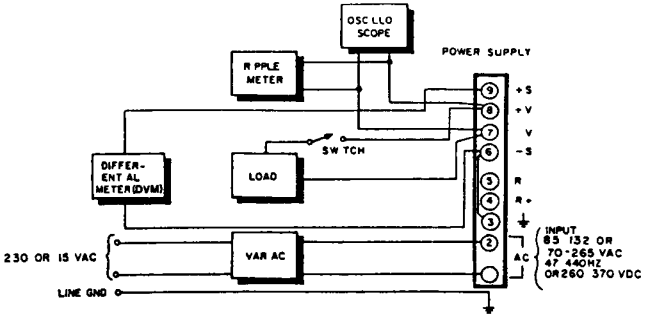
1. Remove AC input power to the supply.
2. Break seal on wiper of R114 from resistor housing and turn to full CCW position.
3. Operate power supply for constant voltage with local sensing connected as shown in Figure 3, with no external load, and with AC input of 170V VAC, 50 Hz or 85 VAC, 60 Hz.
4. Turn voltage adjust control until minimum rated output voltage is obtained.
5. Apply load so that output current is 105% of 40°C rating for the unit. Do not exceed 110% of 40°C rating.
6. Using a different ammeter DC DVM (John Fluke Mode. 891A or equivalent), observe output voltage while adjusting in CW direction. Adjust R114 until output voltage drops.
7. After adjustment is completed, remove AC input power to the supply and reseal wiper of R114.

SERVICE

When additional instructions are required or repair service is desired, contact the nearest office of the Lambda Electronics Corp. where trained personnel and complete facilities are ready to assist you.

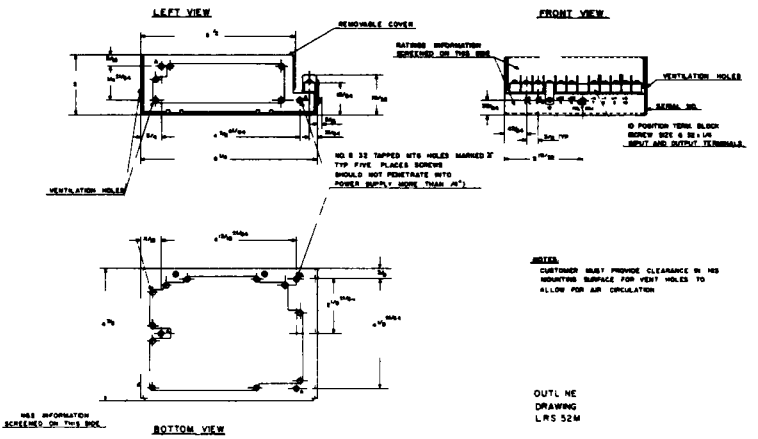
Please include the power supply model and serial number together with complete details of the problem. On receipt of this information Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.



NOTES
1. REGULATION AND RIPPLE CHECK METERS MUST NOT BE GROUNDED THROUGH THREE WIRE LINE CORD TO GROUND.
2. PERFORM CHECKS WITH LOCAL SENSING CONNECT ON ONLY

Test Connections for Performance Checks



Out ne Draw ng

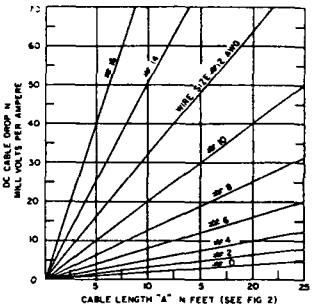


Figure 1 Cable Connection Chart

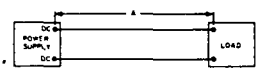
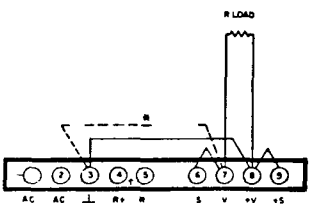
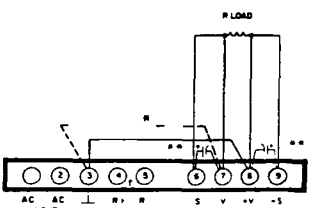


Figure 2 Cable Length A ' in Feet



NOTE
R FOR NEGATIVE GROUND DISCONNECT JUMPER FROM TERMINALS 3 AND 8 AND RECONNECT TO TERMINALS 3 AND 7
† REMOTE ON OFF TERMINALS REFER TO FIGURE 8 FOR PROPER CONNECTION



NOTE
R FOR NEGATIVE GROUND DISCONNECT JUMPER FROM TERMINALS 3 AND 8 AND RECONNECT TO TERMINALS 3 AND 7
** A 2.5MF ELECTROLYTIC CAP MAY BE REQUIRED
† REMOTE ON OFF TERMINALS REFER TO FIGURE 8 FOR PROPER CONNECTION

SCHEMATIC DATA REFERENCES MODELS LRS 52M 2 THRU LRS 52M 48

R e f e r e n c e s f o r C o m p o n e n t s

MODELS	LRS 52M 2	LRS 52M 6	LRS 52M 8	LRS 52M 12	LRS 52M 16	LRS-52M-20	LRS 52M 24	LRS-52M-48
C110	470pF	0.01mF	0.01mF	0.003mF	0.003mF	0.001mF	0.001mF	470mF
	MYLAR	MYLAR	100V	200V	200V	200V	200V	1200V
	100V	100V						DCR
C111	470pF	1200mF	1200mF	2200mF	2200mF	1000mF	1000mF	470mF
C112	ELECT	ELECT	10V	20V	20V	40V	40V	63V
	20%	20%						
C113	470pF	0.01mF	0.01mF	0.003mF	0.003mF	0.001mF	0.001mF	470mF
	MYLAR	MYLAR	100V	200V	200V	200V	200V	1200V
	100V	100V						DCR
C128	FBL	FBL	80V	20V	20V	40V	40V	63V
	QQ	QQ						
CR102	FBM	FBM	50V	10V	10V	16V	16V	35V
CR103	Z	Z						
R104	10K	10K	2W	2W	2W	2W	2W	2W
	METAL	METAL	METAL	METAL	METAL	METAL	METAL	METAL
R105	25K	25K	25K	25K	25K	25K	25K	25K
	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W
	CARB	CARB	CARB	CARB	CARB	CARB	CARB	CARB
R108	5.1K	5.1K	5.1K	5.1K	5.1K	5.1K	5.1K	5.1K
	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
R111	2000	2000	2000	2000	2000	2000	2000	2000
	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W
R112	510K	510K	510K	510K	510K	510K	510K	510K
	1W	1W	1W	1W	1W	1W	1W	1W
	VAR	VAR	VAR	VAR	VAR	VAR	VAR	VAR
R113	4.7K	4.7K	4.7K	4.7K	4.7K	4.7K	4.7K	4.7K
	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
R120	25K	25K	25K	25K	25K	25K	25K	25K
	2W	2W	2W	2W	2W	2W	2W	2W
	DKNOB	DKNOB	DKNOB	DKNOB	DKNOB	DKNOB	DKNOB	DKNOB
	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
	1W	1W	1W	1W	1W	1W	1W	1W
	468	468	468	468	468	468	468	468
	1%	1%	1%	1%	1%	1%	1%	1%
	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	1 J	1 J	1 J	1 J	1 J	1 J	1 J	1 J
R131	1580	1580	1580	1580	1580	1580	1580	1580
	1%	1%	1%	1%	1%	1%	1%	1%
	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R132	1910	1910	1910	1910	1910	1910	1910	1910
	1%	1%	1%	1%	1%	1%	1%	1%
	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R133	4100	4100	4100	4100	4100	4100	4100	4100
	1%	1%	1%	1%	1%	1%	1%	1%
	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W	1/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R134	2200	2200	2200	2200	2200	2200	2200	2200
	1%	1%	1%	1%	1%	1%	1%	1%
	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R135	3010	3010	3010	3010	3010	3010	3010	3010
	1%	1%	1%	1%	1%	1%	1%	1%
	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R136	8060	8060	8060	8060	8060	8060	8060	8060
	1%	1%	1%	1%	1%	1%	1%	1%
	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R137	11000	11000	11000	11000	11000	11000	11000	11000
	1%	1%	1%	1%	1%	1%	1%	1%
	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R138	14000	14000	14000	14000	14000	14000	14000	14000
	1%	1%	1%	1%	1%	1%	1%	1%
	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R139	16600	16600	16600	16600	16600	16600	16600	16600
	1%	1%	1%	1%	1%	1%	1%	1%
	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R140	18000	18000	18000	18000	18000	18000	18000	18000
	1%	1%	1%	1%	1%	1%	1%	1%
	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R141	20000	20000	20000	20000	20000	20000	20000	20000
	1%	1%	1%	1%	1%	1%	1%	1%
	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R142	22000	22000	22000	22000	22000	22000	22000	22000
	1%	1%	1%	1%	1%	1%	1%	1%
	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R143	24000	24000	24000	24000	24000	24000	24000	24000
	1%	1%	1%	1%	1%	1%	1%	1%
	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R144	27000	27000	27000	27000	27000	27000	27000	27000
	1%	1%	1%	1%	1%	1%	1%	1%
	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J
R145	30000	30000	30000	30000	30000	30000	30000	30000
	1%	1%	1%	1%	1%	1%	1%	1%
	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W	3/4W
	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM	F FILM
	J	J	J	J	J	J	J	J