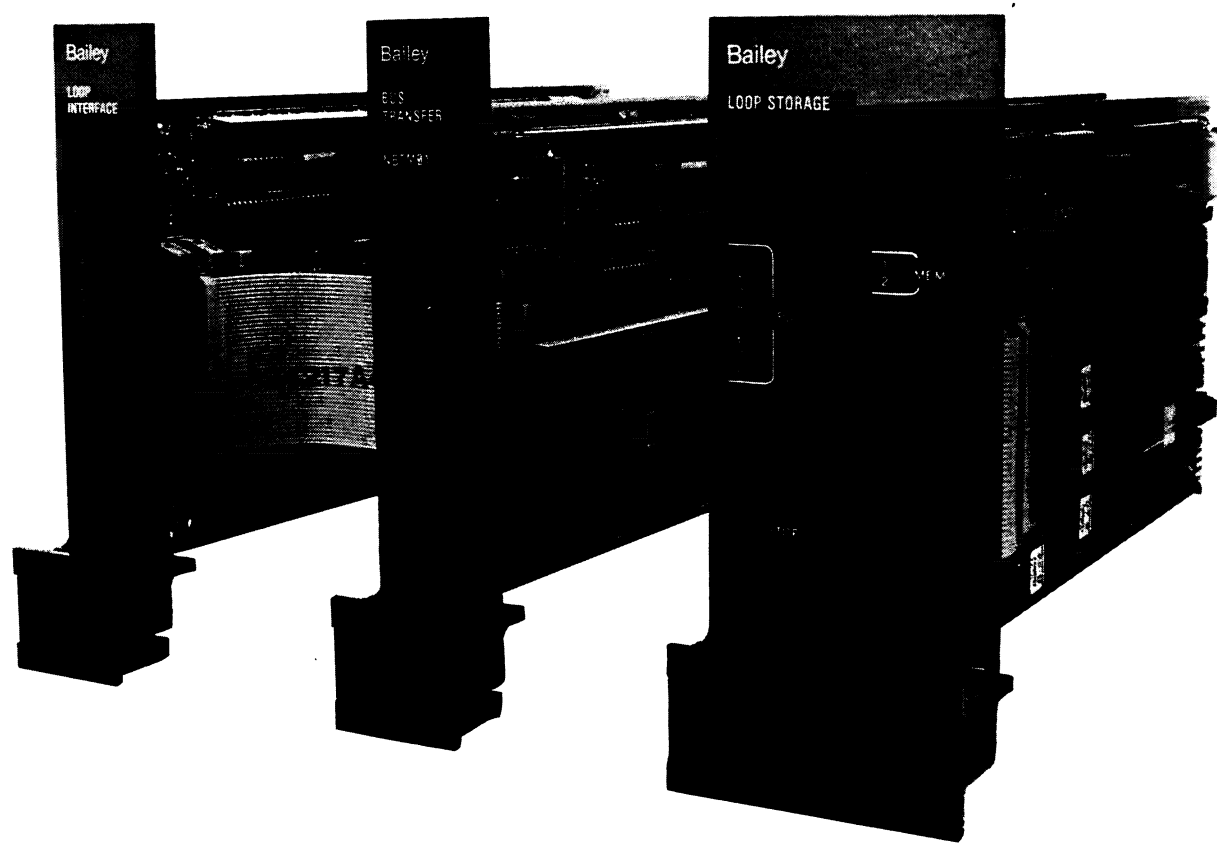




Enhanced Computer Interface Unit Programmer's Reference Manual



A9574

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Preface

The NCIU02/03/04 (CIU) provides interaction between a host computer and the NETWORK 90 System. The CIU receives a command from the host computer, performs the desired action, then formats and returns a reply to the host. There are over 60 CIU commands. These commands permit data acquisition, process monitoring and control, system functions such as security, and time and configuration control.

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INTRODUCTION

The NETWORK 90 Computer Interface Unit (CIU) provides host computer access to a NETWORK 90 system. This access enables the host, a process computer, a 5,000 Tag Operator Interface Unit (OIU), a Management Command System (MCS), or a dumb terminal, to perform:

- Process monitoring and control
- System status monitoring
- Process Control Unit (PCU) configuration

The host links to the CIU via: one or two RS-232-C serial ports, a Parallel Bus Slave module (IEEE-488 parallel cable), or to all three. The CIU interfaces to the communication loop of the NETWORK 90 system. The host interacts with the CIU by issuing a command and receiving the CIU reply.

CIU HARDWARE

The NCIU02/03 consists of three modules:

- Loop Interface Module (LIM)
- Bus Transfer Module (BTM)
- Loop Storage Module (LSM)

The NCIU04 consists of two modules:

- Loop Interface Slave (LIS)
- Superloop Storage Module (SSM)

As an option, a Parallel Bus Slave (PBS) may be used for parallel communications between the CIU and a host. The PBS is an IEEE-488 compatible General Purpose Interface Bus (GPIB) device.

POINT CAPACITIES

This manual is intended to be a reference for the NCIU02, NCIU03, and NCIU04. The difference between the NCIU02 and NCIU03 is the Storage Module used. The NCIU02 and NCIU03 are used on Plant Loop Systems, whereas the NCIU04 is only used on Superloop.

GENERAL DESCRIPTION

CIU Model	Storage Module	Maximum Point Capacity
NCIU02	NLSM01	2,500
NCIU03	NLSM02	5,000
NCIU04	NSSM01	10,000

The NCIU02 and NCIU03 have a NCIU01 compatible mode, permitting them to run software written for the NCIU01. In this mode, the maximum point count for both models is 511.

The NCIU04 has a NCIU02 compatible mode, allowing it to run software written for the NCIU02 or NCIU03.

NCIU01 SOFTWARE WITH NCIU02/03 HARDWARE

Existing software that runs with the NCIU01 also runs with the NCIU02 and NCIU03. Selecting a special mode at the time of the CIU RESTART command, permits NCIU02/03 to look like a NCIU01 to the host computer. When you select this option, you cannot use any of the NCIU02/03 features.

NCIU02 SOFTWARE WITH NCIU04 HARDWARE

Likewise, existing software that runs with the NCIU02/03 also runs with the NCIU04. Selecting a special mode at the time of the CIU RESTART command, permits the NCIU04 to look like a NCIU02 to the host computer. When you select this option, you cannot use any of the new NCIU04 features. In addition, features specific to the NCIU01 are not supported on the NCIU04.

USING THIS MANUAL

The text is arranged into sections by function:

- Section 2 - CIU commands, are arranged in order of command codes.
- Sections 3 through 12 contain numerous references to the commands listed in Section 2. These sections are in the form of notes in the command and reply tables.
- The Appendix includes command codes and a glossary.

RELATED DOCUMENTS

Refer to the following documents for additional information:

Name	Part Number	Publication
Bus Interface Module	NBIM02	E93-908-1
Function Code Reference Manual	-----	E93-900-20
Loop Interface Module	NLIM02	E93-908-1
Loop Interface Slave Module	NLIS01	E93-908-7
Loop Storage Module	NLSM01/02	E93-905-2
Parallel Bus Slave	NPBS01	E93-905-2
Superloop Storage Module	NSSM01	E93-908-7
Termination Units/ Modules	NTCL01/ NICL01 NTMF01/ NIMF01 NTPL01/ NIPL01	E93-911
Cables	NKLS01 NKLS02 NKP01 NKTU01-10/ NKTM01-10	E93-911

SYSTEM OVERVIEW

PCU modules interface with the process and perform control functions. Process control strategy for a specific installation is implemented by configuring an arrangement of function blocks within the system. Function blocks are described in the **Function Code Application Manual - E93-900-20**. NETWORK 90 components transfer process values by an exception reporting procedure. A receiver wanting data from a sender initially requests an exception report route be established from the sender to the receiver. Thereafter, the sender initiates an exception report whenever a value changes significantly.

CIU OVERVIEW

The primary function of the CIU is to allow the host to monitor and control the process. The CIU gives the host access to station variables, block outputs, and module status. These point types are listed in Table A-1 as they relate to host commands.

GENERAL DESCRIPTION

Point types can be read by two methods:

- The host can ask the CIU for exception reports and receive points only as often as the point value changes. (Refer to Table A-1).
- The host can ask the CIU for lists or groups of point values. This method returns the current values, even if the point value has not changed.

The host can output station variables and station modes, to stations that are configured in NETWORK 90 modules. The host can also generate analog, digital, Remote Control Memory (RCM), Remote Manual Set Constant (RMSC), and station exception reports. Other NETWORK 90 modules accept these reports as if they originate from function blocks configured in the host.

Parallel Bus Slave Operation

The Parallel Bus Slave Module (PBS) receives CIU commands from the host and transfers them to the Loop Storage Module (LSM) of the NCIU02/03, or Superloop Storage Module (SSM) of the NCIU04, over the expander bus. When the command reply is formulated, the PBS receives the reply from the LSM over the expander bus and makes the reply available to the host. The expander bus, an 8-bit wide parallel data path, is a standard feature of the NETWORK 90 Module Mounting Unit (MMU).

Use Of The CIU For Process Monitoring

CIU commands are shown in a simple process monitoring application in Figures 1-1 and 1-2. First, the host issues a *CIU RESTART* command to clear the CIU point table. Then it establishes each point from which it will later obtain data. Finally, the host issues one *CONNECT POINT LIST* command causing the system to report values of all established points to the CIU.

Normal Data Acquisition

With the points established and connected, the application can enter its normal data acquisition mode. The host periodically asks the NCIU02/03 for exception reports for the established points with the *READ EXCEPTIONS* command. The functionally similar command for the NCIU04 is *READ DATA EXCEPTIONS*. The CIU replies with the values of the points for which the CIU has received exception reports. Since all of the exceptions may not fit into one *READ EXCEPTIONS* (or *READ DATA EXCEPTIONS*) reply, the host may need to issue the command more than once. After the host exhausts the outstanding CIU exceptions, it processes its application, or waits. This continues until the host determines it is time to read exceptions again.

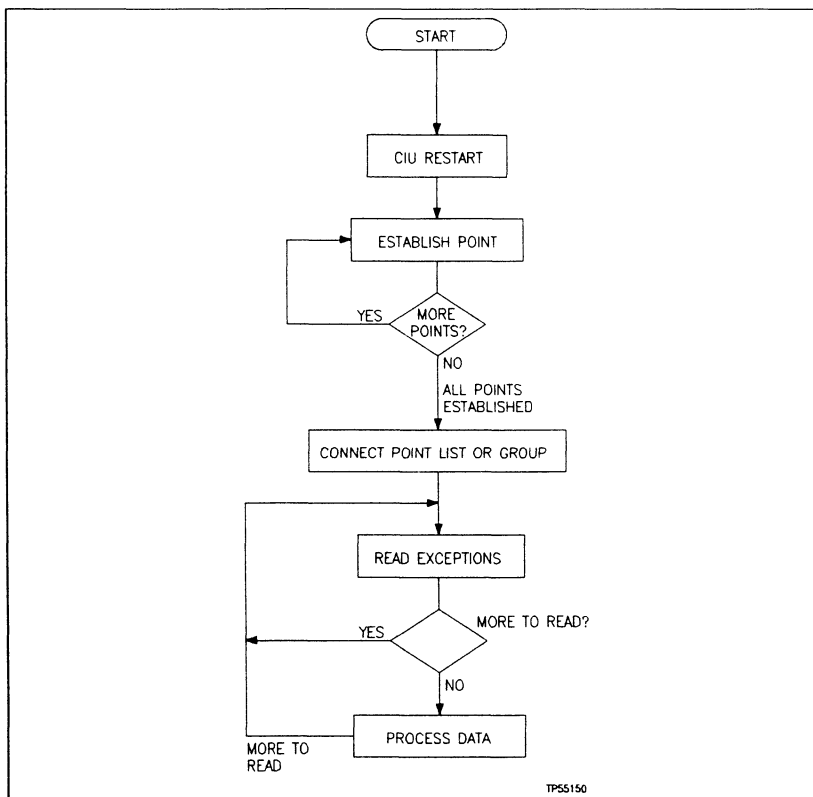


Figure 1-1. Simple Input Application - NCIU02/03

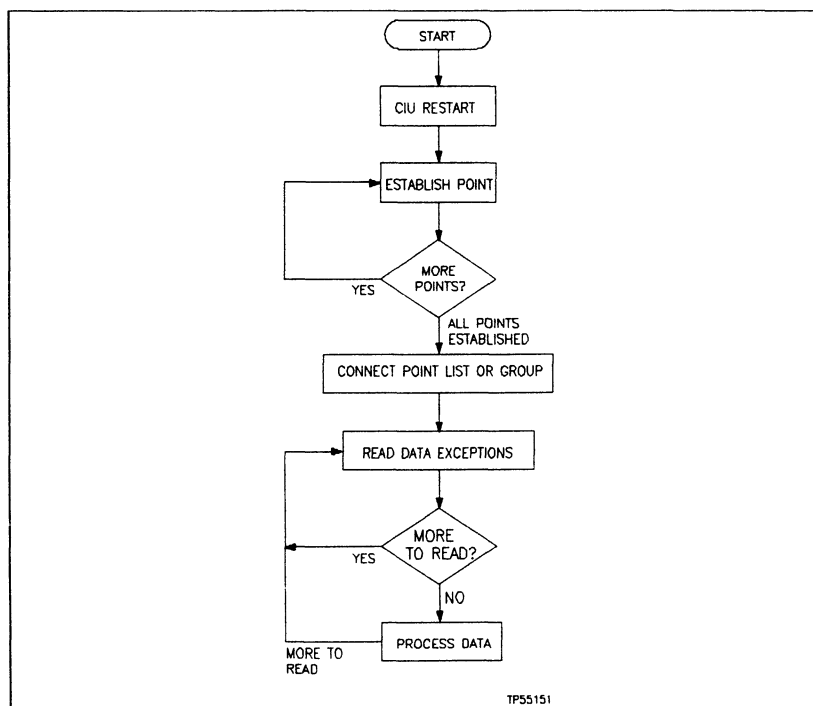


Figure 1-2. Simple Input Application - NCIU04

GENERAL DESCRIPTION

Command Sequence

The overall flow of the host making full use of the CIU is shown in Figure 1-3. The host issues a *CIU RESTART* command before it can configure the PCUs. Points are established, and finally the host proceeds with process I/O.

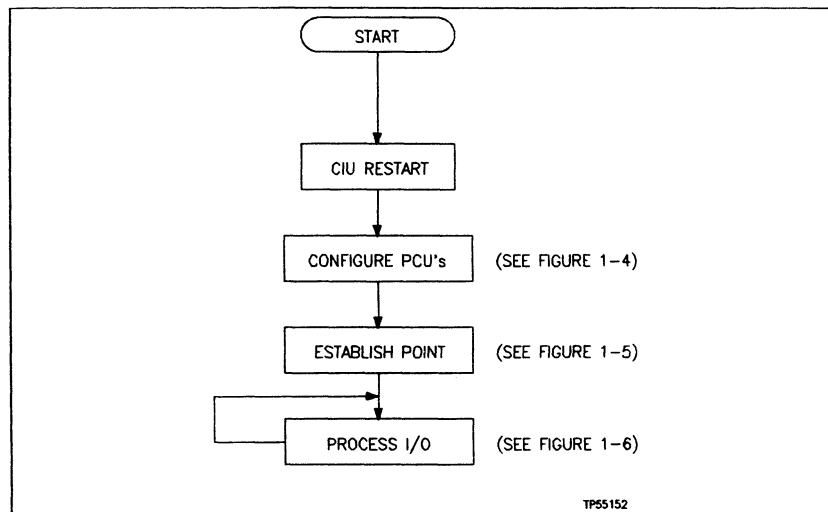


Figure 1-3. Total Application Overview

Host configuration of NETWORK 90 PCUs is a system option, since the OIU, MCS, EWS, and CTM may also be used for configuring PCUs. PCU configuration does not use any space in the CIU point table. Figure 1-4 describes CIU commands available to configure PCUs. Section 6 - **PCU Configuration** details PCU configuration via the CIU.

Establishing Points

ESTABLISH POINT and *ESTABLISH REPORT* establish different types of points (see Figure 1-5).

NOTE: The CIU module number is always 2.

When a point is established as an input to the host, the point's module returns point specifications to the CIU. These specifications contain information such as alarm parameters and engineering units. The host need not read these specifications if the information is not needed. The host cannot predict when specifications will arrive. It must check for specifications as points are established and throughout the course of normal process I/O, until all needed specifications return. Once a point is established, the command sequence shown in Figure 1-6 or 1-7 is available.

DISESTABLISH POINT deletes an established point or report from the CIU internal point table.

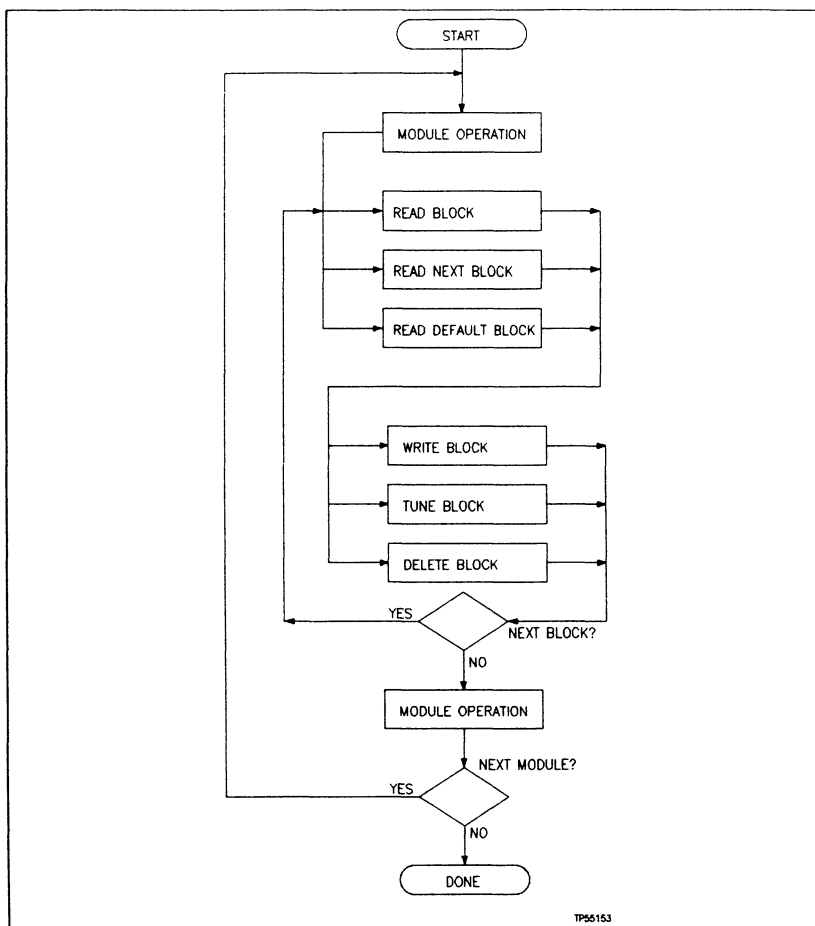


Figure 1-4. CIU Commands to Configure PCUs

Exception Reports for Established Input Points

CONNECT POINT LIST and *CONNECT POINT GROUP* cause the CIU to receive exception reports for established input points. If several points are used by an infrequent application run, the host can reduce loop traffic. It can disconnect these points after an application run and reconnect these points before another application run.

The host can input point data by two different means. First, reading exceptions allows the host to reduce point input to those points with changed values, or reports at expiration of the maximum reporting time interval. Second, reading value and status lists or groups allows the host to specify which points to read. The output of any block can be read without using any space in the CIU point table and without configuring the block to generate exception reports.

If the host finds a module with bad status by one of the above input means, it can issue *READ PROBLEM REPORT* and *READ EXTENDED PROBLEM REPORT* to receive details of the module error.

GENERAL DESCRIPTION

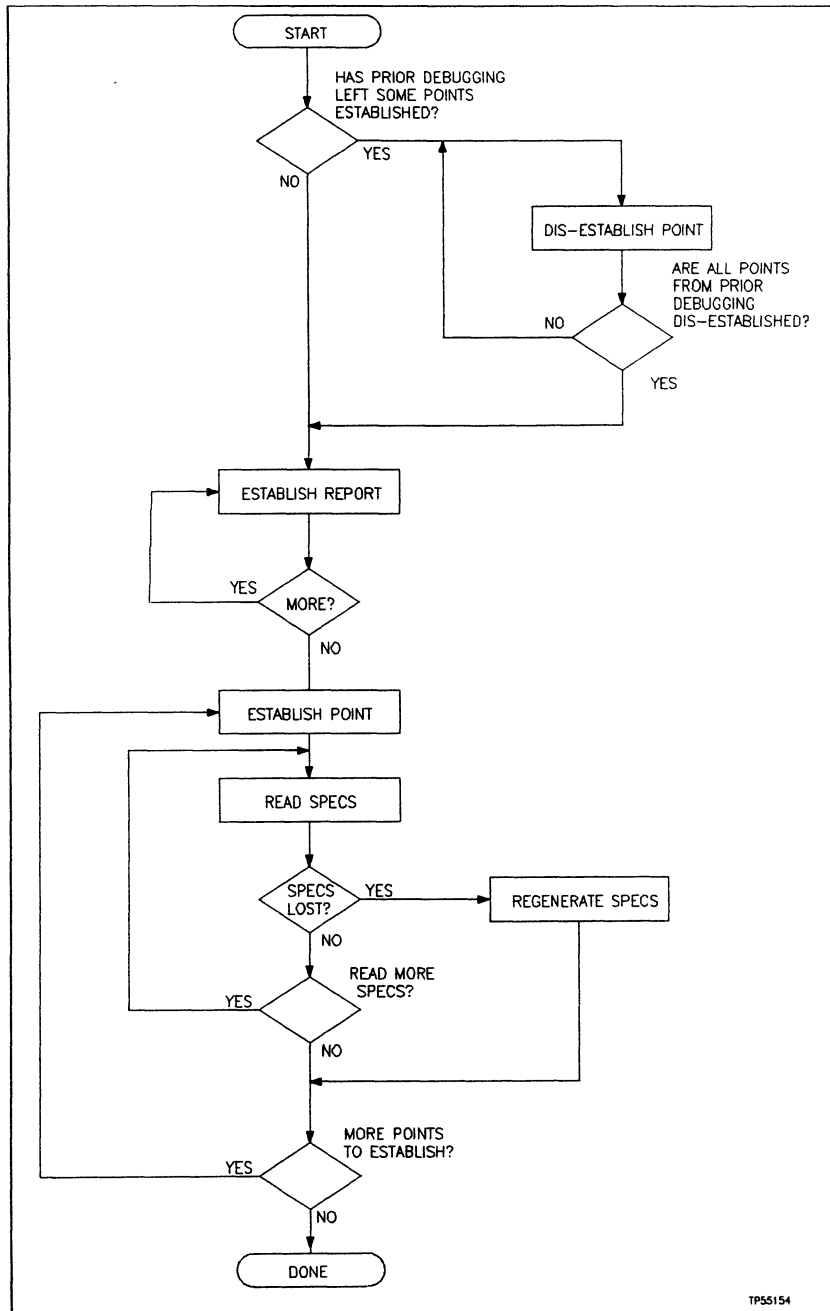


Figure 1-5. Commands Used to Establish Points

Host Outputs

Output Value. The host can use *OUTPUT VALUE/OUTPUT VALUE GROUP* to output the following point types:

- Analog Report
- Digital Report
- RMSC Report
- Station Values written (SP, CO, RI)
- RCM Read

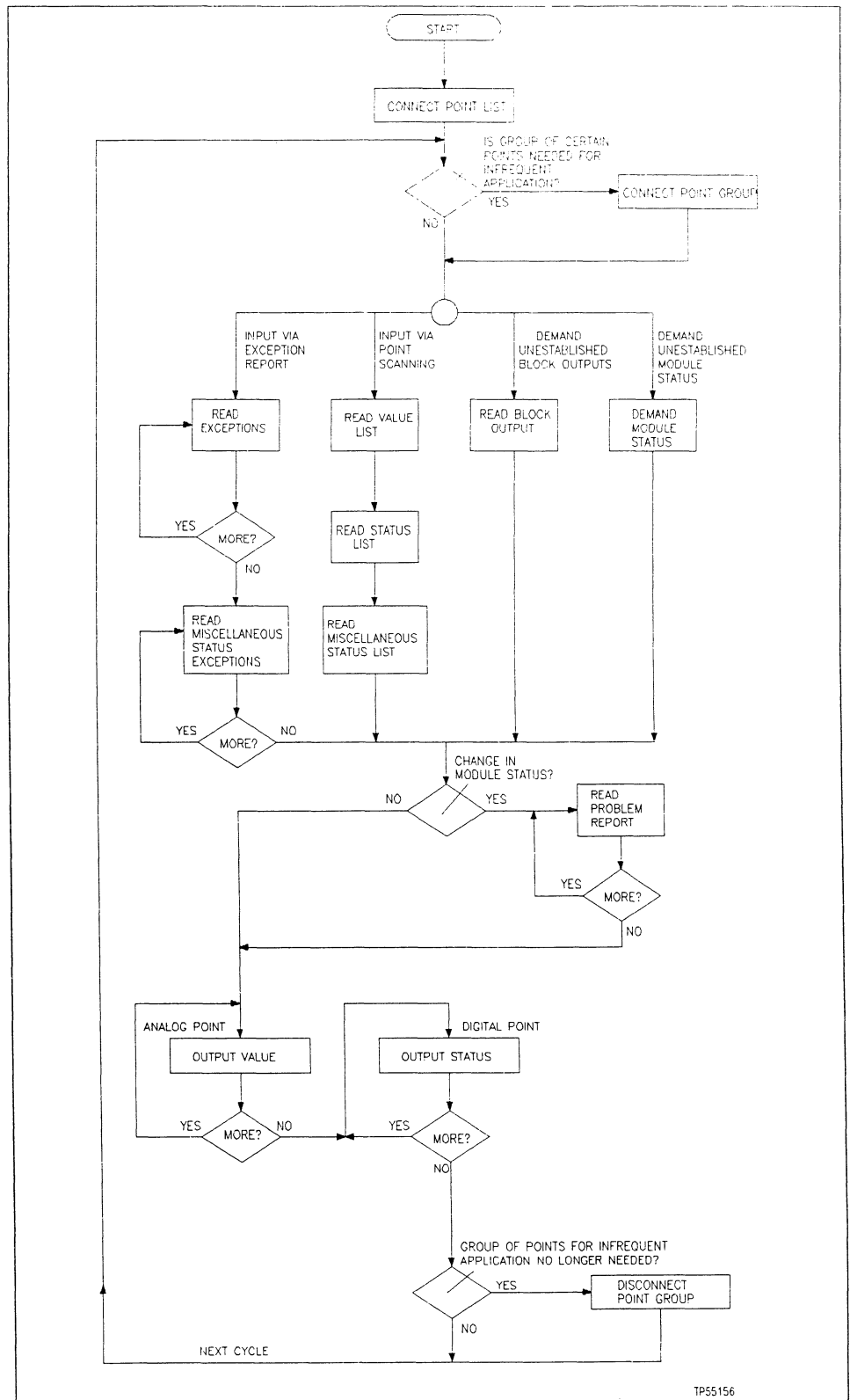


Figure 1-6. Process I/O Overview - NCIU02/03

GENERAL DESCRIPTION

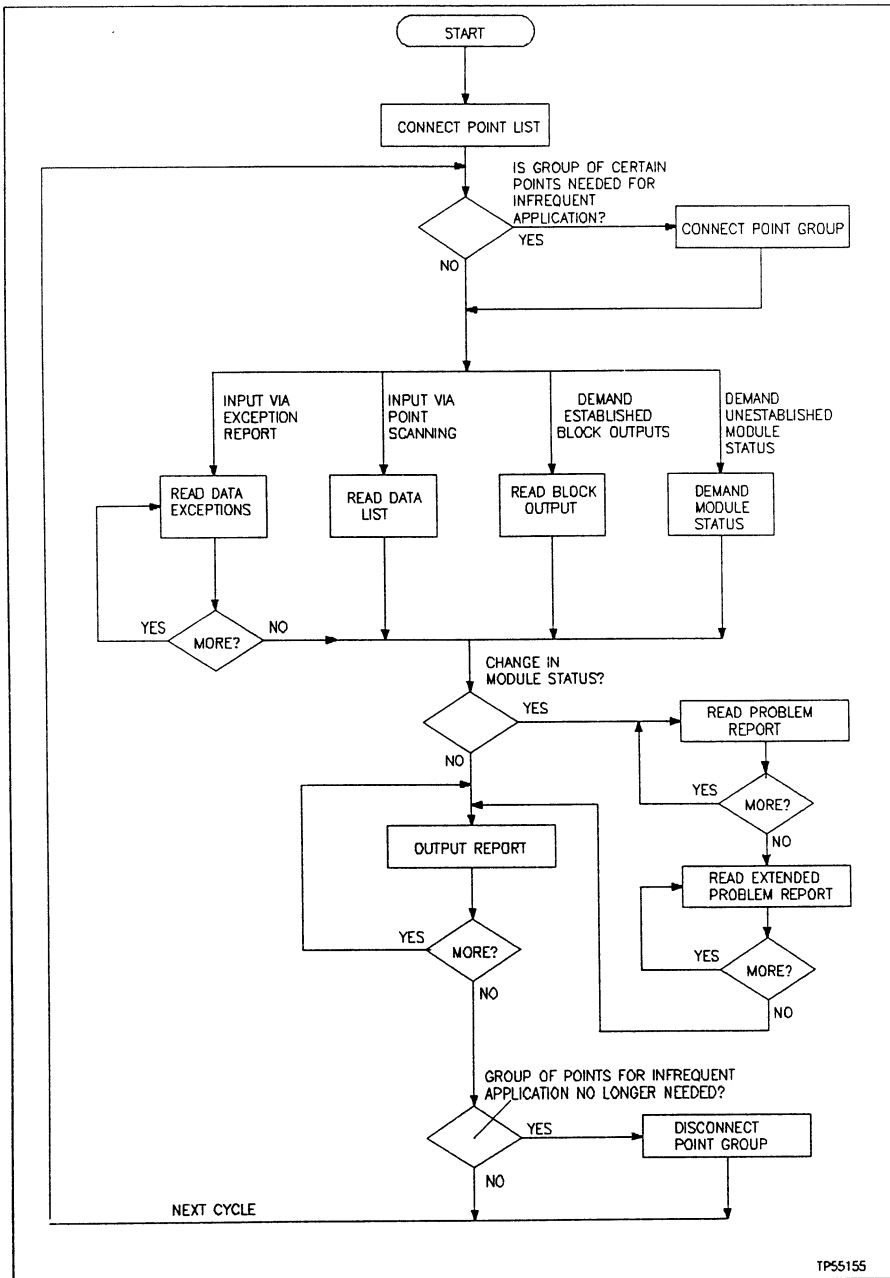


Figure 1-7. Process I/O Overview - NCIU04

In addition to these, the NCIU04 uses *OUTPUT REPORT* to yield the point types:

- Analog Report
- Digital Report
- RCM Report
- Station Report
- RMSC Report
- REAL(4) Analog Report

Report Point types appear to other nodes as if they are configured in the CIU. In this case PCUs, OIUs, and MCSs are configured to establish exception report routes to receive the values from the CIU. With this approach, block number references within the PCUs, OIUs, and MCSs are set equal to corresponding point index numbers

Output Miscellaneous. The host can use *OUTPUT MISCELLANEOUS/OUTPUT MISCELLANEOUS GROUP* to output to an RCM Report point.

GENERAL DESCRIPTION

INTRODUCTION

This section explains the CIU commands. Each description begins with detail of the command and reply format. The **Binary Character Number** column gives the layout of the command and reply. The Data Type column shows whether the field type is code, byte, integer, or analog. The binary format of each field type is defined in Section 3.

Unique values for each command code are given in Table A-12 - Command Summary. Other field values may be given parameters V1, V2, ... to be referred to in the specific command description. Two dots (..) denote the range between the minimum and maximum values.

The **Discussion** describes the purpose, prerequisites, and effects of the command. The Discussion may also refer to other sections in this manual pertaining to the command.

NETWORK 90 Effect describes the impact of using this command on other modules and loop traffic.

COMMANDS

CANCEL KEYED COMMAND

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	50
Key	2	byte	0..32

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

Discussion:

CANCEL KEYED COMMAND causes the CIU to ignore the reply to an outstanding CIU command, and not pass it on to the host computer. The key field of this command must match the key provided in the command to be canceled. If the Key Field of this command is 0, **ALL** outstanding commands are canceled.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected by this command.

CIU CALLUP

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	41
Key	2	byte	0
Passbyte 1	3	byte	V1*
Passbyte 2	4	byte	V1*
Passbyte 3	5	byte	V1*
Passbyte 4	6	byte	V1*
Passbyte 5	7	byte	V1*
Passbyte 6	8	byte	V1*
Passbyte 7	9	byte	V1*
Passbyte 8	10	byte	V1*

*User configured passbytes where, V1: 0..255.

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	(Table 9-1)

Discussion:

When the CIU password protection mode is enabled using Option Settings (refer to Table A-19), *CIU CALLUP* must be issued with the correct passbytes to allow access to all other CIU commands. This procedure provides protection when modems are used for remote computer/CIU communications.

NOTE: This command must be issued on each port to be used for communications. The 8 passbytes are recorded in non-volatile memory using the CIU write password feature, and supported by the onboard utilities.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

COMMANDS

CIU HANGUP

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	42
Key	2	byte	0

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	(Table 9-1)

NOTE: This command should be issued on each port originally enabled by *CIU CALLUP*, before communication channel usage is relinquished.

Discussion:

Use *CIU HANGUP* to disable access to all other CIU commands. With this command, the host gives up access to the communication channel when the CIU password protection mode is enabled by SW5 (refer to Table A-19). This command provides protection when modems are used for remote host/CIU communications.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

CIU ONLINE/OFFLINE

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	44
Key	2	byte	0
Mode	3	byte	0..1*

*V1 = 0, causes CIU to de-energize from the loop (secondary).

V1 = 1, causes CIU to energize onto the loop (primary).

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	(Table 9-1)

Discussion:

CIU ONLINE/OFFLINE allows the host to cause the CIU to become secondary or primary, without issuing *CIU RES-TART*.

Network 90 Effect:

The CIU energizes or de-energizes a relay that redirects loop communication through the LIS (LIM with NCIU02/03) for loop communications. In the energized state the CIU is operating in the primary mode. This causes the CIU to establish and connect points that had been configured while the CIU was in the secondary mode. This also causes reception of exception reports to start. In the de-energized state the CIU is operating in the secondary mode which stops exception reporting. (Other PCUs will mark the CIU as being off-line).

COMMANDS

CIU RESTART

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	19
Key	2	byte	0
Watchdog	3	byte	V1 ¹
Options	4	byte	V2 ²
Reply Delay	5	byte	V3 ³
Interrupt	6	byte	V4 ⁴
Frequency/ Additional Options			

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	
CIU's Node No.	2	byte	
CIU's Ring No.*	3	byte	

* In a NCIU02/03, this byte is Spare.

NOTES:

- Watchdog
= 0, no watchdog timer
> 0, time-out period = 2.5 seconds * Watchdog
- NCIU04: Options = 128 + T + S + W + P + C
NCIU02/03: Options = Z + T + S + X + P + C
where:
Z = 64 if incoming commands are separated from incoming exception reports.
T = 32 if CIU is able to time-synchronize NETWORK 90.
S = 16 if exception report screening is enabled.
W = 8 if the Work Flag value is to be returned as the next two bytes following the Reply Code of every reply. This does not clear the Work Flag. Refer to the READ WORK FLAG command.
X = 4 if X-ON/X-OFF protocol is to be supported.
P = 2 if CIU is primary (on-line).
C = 1 if the host can put stations into Computer mode.
- Delay time = Reply Delay * 1/100 seconds
- NCIU02/03: time in seconds of parallel port work flag interrupt interval.
NCIU04: Additional Options = B + W + T
where:
B = 4 if Bad Quality Alarm Management is to be implemented in the READ DATA EXCEPTIONS, READ DATA GROUP, and READ DATA LIST commands.
W = 2 if Wall Clock Offset is to be added to Time Stamp. (refer to T below)
T = 1 if Time Stamp is to be returned with Status/Value in reply (refer to READ DATA EXCEPTIONS command).

Discussion:

CIU RESTART clears the CIU point table and gives the CIU its executive control parameters. This command affects whether the CIU is primary or secondary. To allow for redundant CIUs, a CIU can be either of the following:

- Primary CIU - sends and receives loop messages to/from other nodes on the loop.
- Secondary CIU - does not send or receive messages but is bypassed by the loop. Thus, there can be a backup CIU with the same loop address as long as only one CIU is primary.

The watchdog allows the CIU to detect a loss of communication (the host goes off-line) with the computer. A loss of communication can result from either a host or CIU failure. The watchdog is expressed in units of 2.5 seconds. Whenever the watchdog interval lapses after a host command, the CIU considers the host off-line. When the CIU finds the host off-line, the CIU becomes secondary.

When the CIU is powered up or hardware is reset, it is secondary. It becomes primary when it accepts a *CIU RESTART* with the primary option, or when it is commanded to become primary with *CIU ONLINE*. This is available as an option so that the host can force a primary CIU to become secondary.

If the command separation option (NOTE 2) is selected, RCM switch commands are returned by *READ COMMAND EXCEPTIONS*. If not selected, then RCM commands are returned by *READ MISCELLANEOUS STATUS EXCEPTIONS*, for NCIU02/03, and NCIU04 when in NCIU02/ 03 mode. The NCIU04 always separates commands from status exceptions when operating in NCIU04 mode.

The NCIU04 option allows the host to select whether or not to maintain total software compatibility with NCIU02. The NCIU04 option enables the use of new commands, and larger command and reply sizes. Choosing NCIU04 in the options field, automatically selects command separation and X-ON/X-OFF protocol support. Byte 6 contains the NCIU04's additional options. The NCIU02/03 requires that the host wait 5 seconds after issuing a *RESTART* command, before issuing any other command. The actual restart operation does not begin until after the CIU has replied to the host. The NCIU04 completes all restart activity before replying to the host; the host should not have to delay after receiving the reply from the NCIU04.

COMMANDS

The host can enable exception report screening. This option screens incoming exception reports issued as a result of maximum reporting times expiring. The CIU avoids reporting exception report data that has not changed once it has been sent to the host.

The host's ability to change a station from local to computer level is an option which the host can forego. This allows a measure of protection against some cases of faulty host operation.

Reply delay slows the CIU response. After sending a command, this allows the host time to get ready for a reply. The delay is the time between the termination code (time-out between bytes) of the command and the beginning of the reply. If CIU processing takes more time than the requested delay, the delay does not further slow the reply. The delay only insures a minimum delay period.

After a hardware reset, *CIU RESTART* must be the first command given, unless password protection is enabled. In this case, the proper password must be supplied in the *CIU CALLUP* command, before the *RESTART* command is issued.

NETWORK 90 Effect:

If the CIU is restarted as primary, other NETWORK 90 components which expect reports re-establish routes. The CIU starts sending and receiving loop messages.

In the case of redundant CIUs, if the CIU is restarted as primary before the former primary CIU times out to secondary, the CIUs destroy each other's messages. Once the former primary CIU times out, the new primary CIU completes its transmission normally. The host does nothing to clear the temporary transmission conflict. If the CIU is restarted in the secondary mode, it has no effect on the NETWORK 90 Loop.

CONNECT POINT GROUP

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	37
Key	2	byte	0
Index (pt 1)*	3..4	integer	1..10,000 ^{Note 1}
Index (pt 2)*	5..6	integer	1..10,000 ^{Note 1}
...	7..102		

*For NCIU02, Value: 1..2,500.

For NCIU03, Value: 1..5,000.

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTE:

1. A maximum of 50 indices can be connected per group. If the command code and key are the only fields issued, the CIU connects the last group of indices that are downloaded. *CONNECT POINT GROUP* and *DISCONNECT POINT GROUP* have a common group definition.

Discussion:

CONNECT POINT GROUP connects routes which have been established. These routes must be connected for the CIU to receive the point's value from its module. Module status points and points written by the host need not be connected.

The host connects points after establishing them and leaves them connected. If the host has several input points established which it uses only for an infrequent application, it can use *DISCONNECT POINT LIST* or *DISCONNECT POINT GROUP* on these points after the application uses them. The host can connect them again the next time the application runs. Disconnecting the points removes unneeded point traffic from the loop.

If any input point from a station is connected, then all points of that station are connected.

NETWORK 90 Effect:

The CIU sends messages to SBMs or BIMs to connect the exception report routes. This causes the SBMs or BIMs to begin sending exception reports.

COMMANDS

CONNECT POINT LIST

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	4
Key	2	byte	0
First index*	3..4	integer	1..10,000
Last Index*	5..6	integer	1..10,000

* For NCIU02, Value: 1..2,500

For NCIU03, Value: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

Discussion:

CONNECT POINT LIST connects established input routes. These routes must be connected for the host to receive the point's value from its module. Module status points and points written by the host do not need to be connected.

In a typical application, the host connects points after establishing them and simply leaves them connected. As an alternative, if the host has several input points established which it uses only for an infrequent application, it can disconnect them with *DISCONNECT POINT LIST* or *DISCONNECT POINT GROUP* after the application uses them. It can connect them again the next time the application runs. Disconnecting the points removes unneeded point traffic from the loop.

If any input point from a station is connected, then all points of that station are connected.

NETWORK 90 Effect:

The CIU sends messages to SBMs or BIMs to connect the exception report routes. This causes the SBMs or BIMs to begin sending exception reports.

DATA FORMATS

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	70
Key	2	byte	0
Integer Format	3..4	integer	Note 1
Real Format	5..6	integer	Note 2
Affected Commands	7..	bytes	Note 3

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	

NOTES:

1. Integer Formats:

- 0 = no format conversion
- 4 = Integer-1
- 5 = Integer-2
- 6 = Integer-4

2. Real Formats:

- 0 = no format conversion
- 1 = REAL(2) (BCC0. REAL(2))
- 2 = REAL(3) (BCC0. REAL(3))
- 3 = REAL(4) (IEEE Single Format)
- 8 = REAL(8) (IEEE Double Format)

3. The list of Affected Commands may include only the following:

- 20 = READ BLOCK OUTPUT
- 48 = TREND DATA POLL

If no Affected Commands are specified, all of the above commands will be affected.

Discussion:

This command defines the formats in which data is to be returned to the host for the specified commands. Integer data will be returned in the format specified by the Integer Format field or in the original format if the field is set to zero. Real data will be returned in the format specified by the Real Format field or in the original format if the field is set to zero. User-defined data will always be returned as received. This command may be issued as often as desired or not at all. Refer to Table A-13 for data format report types.

COMMANDS

DEFINE SYSTEM NODES

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	61
Key	2	byte	0
Node Address 1	3	byte	1..255
Node Type	4	byte	Note 1
Node Address 2	5	byte	1..255
Node Type	6	byte	Note 1
Node Address 3	7	byte	1..255
Node Type	8	byte	Note 1
...	9..126		

Reply:

Field	Binary Char. No	Data Type	Value
Reply Code	1	byte	(Table 9-1)

NOTES:

1. Node Type Values:

- 1 - OIU (LIM/PIM)
- 8 - PCU (LIM/BIM)
- 10 - CIU01
- 16 - CIU02/03
- 16 - MCS (LSM02)
- 16 - OIU (LSM02)

2. This is a variable length command. A minimum of 1 and a maximum of 62 PCUs may be supplied.

3. This command is unavailable with the NCIU04; however, its use does not cause an error.

Discussion:

DEFINE SYSTEM NODES is used to inform the CIU of all other nodes (PCUs, OIUs, MCSs, and CIUs) on the NETWORK 90 plant loop. The system node list must be complete if the trending features of the NETWORK 90 system are to operate properly. The particular CIU that receives this command need not be in the list.

NETWORK 90 EFFECT:

The remainder of the NETWORK 90 system is unaffected by this command.

DELETE BLOCK

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	18
Key	2	byte	0..32 ^{Note 1}
Ring*	3	byte	1..250
Node*	4	byte	1..250
Module	5..6	integer	0..31
Block	7..8	integer	0..65535

*For NCIU02/03, Ring and Node are replaced by:

PCU	3..4	integer	1..63
-----	------	---------	-------

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	Note 2

NOTES:

1. Refer to Key Field in Section 3.
2. Reply codes < 100, refer to Table 9-1.
Reply codes ≥ 100 refer to Table A-2.

Discussion:

DELETE BLOCK removes the block from the module. The module must be in configure mode for this command to function.

This command does not use the CIU point table.

NETWORK 90 Effect:

The CIU sends a *DELETE BLOCK* message to the module and expects a reply.

COMMANDS

DEMAND MODULE STATUS

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	27
Key	2	byte	0..32 <i>Note 1</i>
Ring*	3	byte	1..250
Node*	4	byte	1..250
Module	5..6	integer	0..31

*For NCIU02/03, Ring and Node is replaced by:

PCU	3..4	integer	1..63
-----	------	---------	-------

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	<i>Note 2</i>
Status**	2..17	bytes	<i>Note 3</i>

**For NCIU02/03, Binary Char. No: 2..6

NOTES:

1. Refer to **Key Field** in Section 3.
2. Reply codes < 100, refer to Table 9-1.
Reply codes ≥ 100, refer to Table A-2.
3. For modules that have Extended Module Status, 16 bytes of status are returned (refer to Table A-8).

Discussion:

DEMAND MODULE STATUS allows the host to read the status of any module, even if the module's status is not established in the point list.

The reply is delayed until the module responds to the CIU.

NETWORK 90 Effect:

The CIU sends a read module status message to the module and expects a reply.

DEQUEUE

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	25
Key	2	byte	0..32 ^{Note 1}

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	^{Note 2}
Dequeued reply*	2..1505	bytes	^{Note 1}

*For NCIU02/03, Binary Char. No: 2..500

NOTES:

1. Refer to Key Field in Section 3.
2. Reply codes < 100, refer to Table 9-1.
Reply codes ≥ 100, refer to Table A-2.

Discussion:

DEQUEUE returns the reply queued by the previous command which had a nonzero key. If the reply is not yet ready, the reply code is 1. Refer to **Key Field** in Section 3.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

COMMANDS

DISCONNECT POINT GROUP

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	36
Key	2	byte	0
Index (pt 1)*	3..4	integer	1...10,000 <i>Note 1</i>
Index (pt 2)*	5..6	integer	1...10,000 <i>Note 1</i>
	7...102		

*For NCIU02, Index (pt 1 and 2) range: 1..2,500.
For NCIU03, Index range: 1..5,000.

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTE:

1. A maximum of 50 indices can be disconnected per group. If the command code and key are the only fields issued, the CIU disconnects the last group of indices downloaded. *DISCONNECT POINT GROUP* and *CONNECT POINT GROUP* have a common group definition.

Discussion:

Points are disconnected to keep unneeded traffic off the loop. *CONNECT POINT LIST* and *CONNECT POINT GROUP* are used initially to start exception reporting. Disconnected points do, however, continue to send exception reports which indicate changes of alarm state.

NETWORK 90 Effect:

The CIU disconnects the exception report routes in the PCUs. This stops the SBMs (BIMs with NCIU02/03) from sending the point's exception reports to the CIU. The CIU disconnects the route of a station exception report only if all input points from that station are disconnected.

DISCONNECT POINT LIST

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	5
Key	2	byte	0
First index*	3..4	integer	1..10,000
Last index*	5..6	integer	1..10,000

*For NCIU02, Value: 1..2,500

For NCIU03, Value: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

Discussion:

DISCONNECT POINT LIST disconnects points to keep un-needed traffic off the loop. *CONNECT POINT LIST/CONNECT POINT GROUP* is used originally to start exception reporting. However, disconnected points continue to send exception reports indicating changes of alarm state.

NETWORK 90 Effect:

The CIU disconnects the exception report routes in the PCUs. This stops the SBMs or BIMs from sending the point's exception reports to the CIU. The CIU disconnects the route of a station exception report only if all of the input points from that station are disconnected.

COMMANDS

DISESTABLISH POINT

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	23
Key	2	byte	0
Index*	3..4	integer	1..10,000

*For NCIU02, Value: 1..2,500

For NCIU03, Value: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

Discussion:

DISESTABLISH POINT removes a point from the CIU point table. This point can be re-established by another establish command. This command allows the process computer programmer to change the CIU point table without restarting the CIU. This feature is useful in debugging application programs, as points can be deleted from, or added to, the point table without affecting an existing application program.

This command will not delete routes established by other modules. Before a point of a different type is established with the same index number, all modules must disestablish their routes from the point.

Re-establishing points as different types may make some point table space unusable (refer to Section 11).

NETWORK 90 Effect:

Disestablishing:

- Station variables written by the host has no effect on the NETWORK 90 system.
- Points read by the host cause the CIU to disestablish the associated exception report routes.
- An output report point to which other modules have established routes, causes the CIU to send bad quality exception reports with unassigned type to the modules.
- An output report point to which no modules have established routes has no effect on the NETWORK 90 system.

ENVIRONMENT

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	69
Key	2	byte	0

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	Note 1
Module Type	2	byte	
Module Mode	3	byte	
Firmware Rev.	4..5	ASCII	
Restarted	6	byte	
Online	7	byte	Note 5
Node	8	byte	
Ring	9	byte	

NOTES:

1. Module Types:

- 1 = CIU01
- 2 = CIU02
- 3 = CIU03
- 4 = CIU04

2. Module Modes:

- 1 = CIU01 mode
- 2 = CIU02 mode
- 4 = CIU04 mode

3. The Firmware Revision consists of two ASCII characters that identify the revision of the CIU's firmware. For example, A0 is revision A_0.

4. Restarted:

- 0 = CIU has not been restarted
- 1 = CIU has been restarted

5. Online:

- 0 = CIU is offline
- 1 = CIU is online

DISCUSSION:

This command returns the CIU environmental data. This data identifies the CIU module type and operating mode (the CIU02/03 may be operated in a CIU01 compatible mode and the CIU04 may be operated in a CIU02 compatible mode).

COMMANDS

ESTABLISH AND CONNECT POINT

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	49
Key	2	byte	0
Index*	3..4	integer	1..10,000
Point Type	5	byte	Table A-1 ^{Note 1}
Ring**	6	byte	1..250
Node**	7	byte	1..250
Module	8..9	integer	0..31 ^{Note 3}
Block	10..11	integer	0..65535 ^{Note 4}
Auto-Disconnect	12	byte	0..1 ^{Note 2}

*For NCIU02, Index range: 1..2,500.

**For NCIU03, Index range: 1..5,000.

**For NCIU02/03, Ring and Node are replaced by:

PCU	6..7	integer	1..63
-----	------	---------	-------

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTES

1. This command is only valid for those point types which require both an establish and a connect point command. These include the following point types:

Type	Meaning	Type	Meaning
1	Process Variable Read	7	Digital Read
2	Set Point Read	15	RCM Read
3	Control Output Read	17	Station Read
4	Ratio Index Read	19	RMSC Read
5	Analog Read	21	REAL(4) Analog Read
6	Station Status		(NCIU04 only)

Other point types will require either *ESTABLISH POINT* or *ESTABLISH REPORT*.

2. If this option (field) is set to 1, the index is disconnected immediately after the first exception report is received. No further exception reports are received until the host issues *CONNECT POINT LIST* or *CONNECT POINT GROUP* command that includes this index, or until the alarm state of the point changes. If this option is set to 0, the index remains connected and continues to receive exception reports until it is disconnected with *DISCONNECT POINT LIST* or *DISCONNECT POINT GROUP*.

3. For point Types 14 and 23, the value range is 0 to 31.

4. For Point Types 14 and 23, Block must be 0. Block 0 is illegal for all other Point Types.

Discussion:

ESTABLISH and *CONNECT POINT* enters a point into the CIU point table, and establishes and connects a route so the index receives exception reports. This command has the same effect as issuing *ESTABLISH POINT* and *CONNECT POINT* for the index. For further discussion, refer to *ESTABLISH POINT* and *CONNECT POINT LIST*.

NETWORK 90 Effect:

If the CIU is primary, a route is established to the SBM (BIM with NCIU02/03) of the remote PCU. Exception reporting begins, and the point's specifications are sent by the remote PCU. If auto-disconnect was selected, the point is disconnected after the first exception report is received, but the route remains established.

COMMANDS

ESTABLISH POINT

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	1
Key	2	byte	0
Index*	3..4	integer	1..10,000
Point Type	5	byte	Note 1
Ring ^{Note 2}	6	byte	1..250
Node ^{Note 2}	7	byte	1..250
Module	8..9	integer	0..31 ^{Note 3}
Block	10..11	integer	0..65535 ^{Note 4}

* For NCIU02, Value: 1..2,500
For NCIU03, Value: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTES:

1. Point Types for this command are given in Table A-1 of the Appendix.
2. For NCIU02/03, the Ring and Node Fields are replaced by PCU as follows:

PCU	6..7	integer	1..63
-----	------	---------	-------

3. For Point Types 14 and 23, the value range is 0 to 31.
4. For point types 14 and 23, Block must be 0. Block 0 is illegal for all other point types.

Discussion:

ESTABLISH POINT enters a point in the CIU point table and establishes exception report receiving routes. The command assigns the point a unique index in the point table. The command provides all the information about the point which the CIU needs to handle the loop.

The host issues one command for each point entered into the point table. This command may establish any of the following point types which are read, except where noted, by the host.

Host Command	Point Type
Station Process Variable (PV)	1
Station Set Point (SP)	2
Station Control Output (CO)	3
Station ratio index	4
Analog blocks	5
Station status	6
Digital blocks	7
Station SP (written by the host)	8
Station CO (written by the host)	9
Station ratio index (written by the host)	10
Station mode (written by the host)	11
Module status	14
Remote Control Memory (RCM)	15
Single Index Station points (read and written by the host)	17
Remote Manual Set Constant (RMSC) points	19
REAL(4) Analog blocks*	21
Extended Module Status*	23

*Used only with the NCIU04

ESTABLISH REPORT establishes other point types. A station variable is read as one point and written as a different point.

Points must refer to unique items. For example, PCU A, Module B, Block C, Station Set Point must not be established at more than one point.

The CIU status is automatically established as index 0.

NETWORK 90 Effect:

ESTABLISH POINT effect on the NETWORK 90 system varies depending on whether the point is a station variable read by the host, written by the host, or a non-station block read by the host.

Establishing a station variable to be read by the host causes the CIU to enter the station route in its own routing table. The CIU then attempts to establish the route with the Super-loop Bus Module (SBM) in an NCIU04, or Bus Interface Module (BIM) in the NCIU02/03, in the station's PCU. Once the route is established and the station is executing, the station's SBM, or BIM sends exception report specifications

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to the CIU. Exception reports without an alarm state change will not be sent to the CIU until the host issues *CONNECT POINT LIST*, or *CONNECT POINT GROUP* which includes this point.

Establishing a station variable to be written by the host has no effect on the rest of the NETWORK 90 system. Exception report routing is not done by the CIU for these points.

Establishing a non-station block to be read by the host causes the CIU to establish a route for the block's exception reports. Once the block's module is executing and the exception report route is established, the SBM, or BIM of the block's PCU sends exception report specifications to the CIU. Exception reports are not sent to the host until it issues *CONNECT POINT LIST*, or *CONNECT POINT GROUP*.

ESTABLISH REPORT

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	2
Key	2	byte	0
Index *	3..4	integer	1..10,000
Point Type	5	byte	V1 ^{Note 1}
Field A	6	byte	^{Note 2}
Field B	7..9	analog	
Field C	10..12	analog	
Field D	13..15	analog	
Field E	16..18	analog	^{Notes 2 & 3}
Field F	19..21	analog	
Field G	22..24	analog	
Field H	25	byte	

*For NCIU02, Value: 1..2,500

For NCIU03, Value: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	(Table 9-1)

NOTES:

1. V1 can have any of the following five values defined in Table A-1:

- V1 = 12, if establishing Analog Report
- V1 = 13, if establishing Digital Report
- V1 = 16, if establishing RCM Report
- V1 = 18, if establishing Station Report
- V1 = 20, if establishing RMSC Report
- V1 = 22, if establishing REAL(4) Analog Report
(For NCIU04, only)

2. Information for fields A through E depends on the point type according to Table 2-1.

3. Fields B through H may be omitted for Digital and RCM reports. Fields F through H may be omitted for report types other than Station Report.

For REAL(4) Analog Report, the Binary Character Numbers for Fields B through H are as follows:

B	-	7..10	F	-	23..26
C	-	11..14	G	-	27..30
D	-	15..18	H	-	31
E	-	19..22			

Table 2-1. Report Types for Fields A Through E

Field	Analog Report (Table A-3)	Digital Report (Table A-4)	RCM Report (Table A-17)	Station Report (Table A-3)	RMSC Report (Table A-3)	REAL(4) Analog Report (Table A-3)
A	Eng. Unit	Alarm Spec	Type Code	Eng. Unit	Eng. Unit	Eng. Unit
B	Zero	0.0 (N/A)	0.0 (N/A)	High Alarm	Low Limit	Zero
C	Span	0.0 (N/A)	0.0 (N/A)	Low Alarm	Limit Span	Span
D	High Alarm	0.0 (N/A)	0.0 (N/A)	Dev. Alarm	High Limit	High Alarm
E	Low Alarm	0.0 (N/A)	0.0 (N/A)	PV & SP Span	Low Limit	Low Alarm
F	0.0 (N/A)	0.0 (N/A)	0.0 (N/A)	PV Zero	0.0 (N/A)	0.0 (N/A)
G	0.0 (N/A)	0.0 (N/A)	0.0 (N/A)	SP Zero	0.0 (N/A)	0.0 (N/A)
H	0 (N/A)	0 (N/A)	0 (N/A)	Stn. Type (Table A-18)	0.0 (N/A)	0.0 (N/A)

Discussion:

ESTABLISH REPORT enters the report point in the CIU table. This command also supplies report specifications to remote destinations expecting exception reports from this point. The point appears as a block to the other modules in the NETWORK 90 system (index number = block number). **Analog and Digital Output Reporting** in Section 4 discusses output reporting.

NETWORK 90 Effect:

This command causes the CIU to immediately send point specification messages to modules which have already established routes. As other modules establish routes, the CIU responds by sending the point specifications.

MODULE OPERATION

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	12
Key	2	byte	0..32 ^{Note 1}
Operation	3	byte	1..4
Ring*	4	byte	1..250
Node*	5	byte	1..250
Module	6..7	integer	0..31

*For NCIU02/03, Ring and Node are replaced by:

PCU	4..5	integer	1..63
-----	------	---------	-------

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	^{Note 2}

NOTES:

1. Refer to Key Field in Section 3.
2. Reply codes < 100, refer to Table 9-1.
Reply codes ≥ 100, refer to Table A-2.

Discussion:

MODULE OPERATION resets the module or puts it into configure or execute mode. Refer to Section 6 - **PCU Configuration**. This command does not use the CIU point table.

COMMANDS

OUTPUT MISCELLANEOUS

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	45
Key	2	byte	0
Index*	3..4	integer	1..10,000
Status	5..9	bytes	Note 2
...	10..352		Note 2

* For NCIU02, Index range: 1..2,500
For NCIU03, Index range: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTES:

1. RCM Report Status is described in Table A-15.
2. For point types refer to Table A-1.

Discussion:

OUTPUT MISCELLANEOUS outputs a RCM report. The point must have been established as a RCM report with *ESTABLISH REPORT*.

NETWORK 90 Effect:

The CIU sends one exception report to each module which has an established and connected route to the point.



E93-905-9

Instruction Supplement

Enhanced Computer Interface Unit Programmer's Reference Manual

The following information is an addition to the "Enhanced Computer Interface Unit Programmer's Reference Manual". Please update your manual to reflect this change. The next printing of this manual will include this information.

1.0 Change page 2-28 to show the following;

OUTPUT MISCELLANEOUS

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	3 **
Key	2	byte	0
Index*	3..4	integer	1..10,000
Status	5..9	bytes	Note 2
...	10..352		Note 2

*For NCIU02, Index range: 1..2,500
For NCIU03, Index range: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTES:

1. RCM Report Status is described in Table A-15. (Plus A-26 and A-27 for DDB and MSDD)
2. For point types refer to Table A-1.

Discussion:

OUTPUT MISCELLANEOUS outputs a RCM report. The point must have been established as a RCM report with *ESTABLISH REPORT*.

NETWORK 90 Effect:

The CIU sends one exception report to each module which has an established and connected route to the point.

** Changes effected by this Supplement.

2.0 Change page 2-29 to show the following;

OUTPUT MISCELLANEOUS GROUP

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	45 **
Key	2	byte	0
Index *	3..4	integer	1..10,000
Status	5..9	byte	Note 1

* For NCIU02, Value: 1..2,500

For NCIU03, Value: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTES:

1. RCM report status is described in Table A-15.
2. A maximum of 50 indices can be output per group.

Discussion:

OUTPUT MISCELLANEOUS GROUP sends a maximum group of 50 RCM reports. The point must have been established as an RCM Report (Point Type 16) with *ESTABLISH REPORT*.

NETWORK 90 Effect:

The CIU sends one exception report, for each index in the group, to each module with an established and connected route to that index.

** Changes effected by this Supplement.

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OUTPUT MISCELLANEOUS GROUP

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	3
Key	2	byte	0
Index *	3..4	integer	1..10,000
Status	5..9	byte	Note 1

*For NCIU02, Value: 1..2,500

For NCIU03, Value: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTES:

1. RCM report status is described in Table A-15.
2. A maximum of 50 indices can be output per group.

Discussion:

OUTPUT MISCELLANEOUS GROUP sends a maximum group of 50 RCM reports. The point must have been established as an RCM Report (Point Type 16) with *ESTABLISH REPORT*.

NETWORK 90 Effect:

The CIU sends one exception report, for each index in the group, to each module with an established and connected route to that index.

COMMANDS

OUTPUT REPORT*

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	67
Key	2	byte	0
Point Type (pt 1)	3	byte	Note 1
Index (pt 1)	4..5	integer	1..10,000
Status/Value (pt 1)	6..	Note 2	
Point Type (pt 2)	--	byte	Note 1
Index (pt 2)	--	integer	1..10,000
Status/Value (pt 2)		Note 2	
:	:	:	
:	:	:	
	1505		

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	

*This command is only available with the NCIU04.

NOTES:

1. Table A-2 defines the Point Types accepted by this command.
2. The format of the Status/Value field depends on the Point Type field. The Status/Value fields are defined in Table A-32 of the Appendix.

Discussion:

This command sends exception reports. The points must have been established with *ESTABLISH REPORT*.

Similar commands are *OUTPUT VALUE*, *OUTPUT VALUE GROUP*, *OUTPUT STATUS*, *OUTPUT STATUS GROUP*, *OUTPUT MISCELLANEOUS STATUS*, *OUTPUT MISCELLANEOUS STATUS GROUP*, and *OUTPUT STATION REPORT*.

OUTPUT STATION GROUP

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	57
Key	2	byte	0
Index 1*	3..4	integer	1..10,000
Variable Code 1	5	byte	Note 1
Value 1	6..8	analog	
Index 2	9..10	integer	1..10,000*
...	11..302		

* For NCIU02, Index range: 1..2,500
 For NCIU03, Index range: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTE:

1. Variable Code: 1 Set Point
 2 Ratio Index
 3 Control Output

Discussion:

OUTPUT STATION GROUP sets a maximum group of 50 station variables. The indices must have been established as Single Index Station Read (type 17) points with *ESTABLISH POINT*.

OUTPUT VALUE and *OUTPUT STATUS* are similar. *OUTPUT VALUE* and *OUTPUT VALUE GROUP* send analog or digital exception reports for points established with *ESTABLISH REPORT*. *OUTPUT VALUE* and *OUTPUT VALUE GROUP* also set station variables (point types 8, 9, and 10) established with *ESTABLISH POINT*. *OUTPUT STATUS* may be used to set station mode or to output a report of a digital point. The progress of a write to a station read point may be checked with *READ MISCELLANEOUS STATUS LIST* or *READ MISCELLANEOUS STATUS GROUP* (refer to **Station Control** in Section 4). *OUTPUT REPORT* can also be used to output station values.

NETWORK 90 Effect:

The CIU sends a set station variable command for each station variable in the group. Each station affected sends a loop exception report back to the CIU if the CIU had connected a route to that station.

COMMANDS

OUTPUT STATION REPORT

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	59
Key	2	byte	0
Index*	3..4	integer	1..10,000
Field A	5	byte	Note 1
Field B	6..8	analog	Note 1
Field C	9..11	analog	Note 1
Field D	12..14	analog	Note 1
Field E	15..17	analog	Note 1
Field F	18	byte	Note 1

* For NCIU02, Index range: 1..2,500
For NCIU03, Index range: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	(Table 9-1)

NOTE:

1. The information in fields A to F is the specification data for the station report, arranged as follows:

Field	Description
A	Station Quality Status (Table A-5)
B	PV Value
C	SP Value
D	CO Value
E	RI Value
F	Station Mode Status (Table A-7)

Discussion:

OUTPUT STATION REPORT is used to set station values for a Station Report point type. The given values are used to generate exception reports. This point must have been established as a Station Report point with *ESTABLISH STATION REPORT*. *OUTPUT REPORT* is a similar command that can also be used to output station reports.

NETWORK 90 Effect:

The CIU sends one exception report to each module which has an established and connected route to the given index.

OUTPUT STATION VALUE

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	56
Key	2	byte	0
Index*	3..4	integer	1..10,000
Variable Code	5	byte	Note 1
Value	6..8	analog	

*For NCIU02, Index range: 1..2,500

For NCIU03, Index range: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTES:

1. Variable Code:
- | | |
|---|----------------|
| 1 | Set Point |
| 2 | Ratio Index |
| 3 | Control Output |

Discussion:

OUTPUT STATION VALUE sets a station variable for a Single Index Station Read (Type 17) point. The station must have been established with the *ESTABLISH POINT*.

OUTPUT VALUE and *OUTPUT STATUS* are similar. *OUTPUT VALUE* and *OUTPUT VALUE GROUP* send analog or digital exception reports for points established with *ESTABLISH REPORT*. *OUTPUT VALUE* and *OUTPUT VALUE GROUP* also set station variables (point types 8, 9, and 10) established with *ESTABLISH POINT*. *OUTPUT STATUS* may be used to set station mode or to output a report of a digital point. The progress of a write to a station read point may be checked with *READ MISCELLANEOUS STATUS LIST* or *READ MISCELLANEOUS STATUS GROUP* (refer to Station Control in Section 4). *OUTPUT REPORT* can also be used to output station values.

NETWORK 90 Effect:

The CIU sends a set station variable command to each module associated with the indicated index. Each module sends a loop exception report, back to the CIU, for each index that had been connected.

COMMANDS

OUTPUT STATUS

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	11
Key	2	byte	0
Index*	3..4	integer	1..10,000
Status	5	byte	Note 1

*For NCIU02/03, Value: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTES:

1. Refer to Table A-10 for Digital Report point status; Table A-11 for Station Mode and Index Station Read status.

Refer to Table A-16 for Remote Switch (RCM) status; Table A-28 for Device Driver (FC 123) command status. Multistate Device Driver (FC 129) command status is described in Table A-29. Remote Motor Control status is described in Table A-31.

Device Driver, Multistate Device Driver and Remote Motor Control function blocks are accessed through the RCM read point type.

Discussion:

Use *OUTPUT STATUS* to output a digital point report, to set station mode, to set or reset an RCM function block, or to command a Device Driver. Digital Report points must have been established with *ESTABLISH REPORT*. Station Mode, Single Index Station Read, and RCM points must have been established with *ESTABLISH POINT*. The host cannot change a station to host level, unless *CIU RESTART* is issued with the station control option enabled.

With the NCIU04, *OUTPUT REPORT* is a similar command that combines most of the capabilities of *OUTPUT STATUS*, *OUTPUT VALUE*, and *OUTPUT STATION REPORT*.

NETWORK 90 Effect:

To set a station mode, the CIU sends a set mode message. To set or reset an RCM function block the CIU sends a remote switch command. To output a report, the CIU sends one exception report to each module that has established and connected a route to the point.

OUTPUT STATUS GROUP

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	47
Key	2	byte	0
Index*	3..4	integer	1..10,000
Status	5	byte	Note 1
...	6..152		Note 2

*For NCIU02, Index range: 1..2,500

For NCIU03, Index range: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTES:

1. Refer to Table A-6 for Digital Report point status; Table A-11 for Station Mode and Single Index Station Read status; Table A-16 for Remote Switch (RCM) status; Table A-28 for Device Driver (FC 123) command status; Table A-29 for Multistate Device Driver (FC 129) command status; Table A-31 for Remote Motor Control command status (Device Driver, Multistate Device Driver and Remote Motor Control function blocks are accessed through the RCM read point type).

2. A maximum of 50 indices can be output per group.

Discussion:

OUTPUT STATUS GROUP sends a maximum group of 50 digital exception reports, and/or set station modes, and/or remote switch commands. Use **OUTPUT STATUS GROUP** to output a digital point report, to set station mode, to set or reset an RCM function block, or to command a Device Driver. Digital Report points must have been established with **ESTABLISH REPORT**. Station Mode, Single Index Station Read, and RCM points must have been established with **ESTABLISH POINT**. The host cannot change a station to host level unless **CIU RESTART** is issued with the station control option enabled.

NETWORK 90 Effect:

To set a station mode, the CIU sends a set mode message. To set or reset an RCM function block, the CIU sends a remote switch command. To output a report, the CIU sends one exception report, for each point within the group, to each module that has an established and connected route.

COMMANDS

OUTPUT VALUE

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	10
Key	2	byte	0
Index*	3..4	integer	1..10,000
Status	5	byte	Note 1
Value	6..8	analog	

* For NCIU02, Value: 1..2,500
For NCIU03, Value: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTES:

1. The Digital Point Report Status is described in Table A-6.
The Analog Report Status is described in Table A-5.

2. For point types refer to Table A-1.

Discussion:

OUTPUT VALUE sends an analog or digital exception report, or sets a station variable or Remote Manual Set Constant (RMSC). The point must have been established as an output using **ESTABLISH REPORT**, except for station variables (SP, CO, and ratio) which are established with **ESTABLISH POINT**. If this command is used for a digital report, the value field must be given but is not used.

With a NCIU04, **OUTPUT REPORT** is a similar command that combines most of the capabilities of **OUTPUT VALUE**, **OUTPUT STATUS**, and **OUTPUT STATION REPORT**.

NETWORK 90 Effect:

The CIU sends one exception report to each module which has established and connected a route to the given point. The CIU sends a message to the station, or remote RMSC point commanding it, to assume the given value.

OUTPUT VALUE GROUP

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	40
Key	2	byte	0
Index (pt 1)	3..4	integer	1..10,000*
Status (pt 1)	5	byte	Note 1
Value (pt 1)	6..8	analog	
...	9..302		Note 2

*For NCIU02, Index (pt 1) range: 1..2,500

For NCIU03, Index (pt 1) range: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

NOTES:

1. The Digital Report point status is described in Table A-6.
The Analog Report status is described in Table A-5.

2. A maximum of 50 indices can be output per group.

Discussion:

OUTPUT VALUE GROUP sends a maximum group of 50 analog, digital, or RMSC exception reports or commands that set station variables or RMSC values. The points must have been established as outputs using *ESTABLISH REPORT* except for station variables (Point Types 8 through 10) which must have been established with *ESTABLISH POINT*. If this command is used for digital reports, the value field must be given but is not used.

NETWORK 90 Effect:

The CIU sends one exception report to each module which has an established and connected route for each point in the group. The CIU sends commands to stations or remote RMSC points commanding them to assume the given values.

COMMANDS

QUICK RESPONSE XR

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	62
Key	2	byte	0
Action	3	byte	0 or 1
Index (pt 1)	4..5	integer	1..10,000
Index (pt 2)	6..7	integer	1..10,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	

NOTES:

1. This command is not implemented by the CIU04. However, it will still be accepted by the CIU04 to maintain compatibility with the CIU02/03.
2. This command will increase Plant Loop traffic, not Super-loop traffic.

READ BLOCK

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	13
Key	2	byte	0..32 ^{Note 1}
Ring*	3	byte	1..250
Node*	4	byte	1..250
Module	5..6	integer	0..31
Block	7..8	integer	0..65535

*For NCIU02/03, Ring and Node are replaced by:

PCU	3..4	integer	1..63
-----	------	---------	-------

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	^{Note 2}
Block Data	2..112	bytes	^{Note 1}

NOTES:

1. Refer to Section 6 - PCU Configuration.
2. Reply codes < 100, refer to Table 9-1.
Reply codes ≥ 100, refer to Table A-2.

Discussion:

READ BLOCK reads a block configured in a NETWORK 90 Module. Refer to Section 6 - **PCU Configuration**. Note that block configuration can only be read while the module is in configure or execute mode.

This command does not use the CIU point table.

NETWORK 90 Effect:

The CIU sends a Read Block message to the module and expects a reply.

COMMANDS

READ BLOCK OUTPUT

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	20
Key	2	byte	0..32 Note 1
Ring*	3	byte	1..250
Node*	4	byte	1..250
Module	5..6	integer	0..31
Block	7..8	integer	0..65535

*For NCIU02/03, Ring and Node are replaced by:

PCU	3..4	integer	1..63
-----	------	---------	-------

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	Note 2
Report Type	2	byte	(Table A-13)
Report	3	byte	Note 3

NOTES:

1. Refer to **Key Field** in Section 3.
2. Reply codes < 100, refer to Table 9-1.
Reply codes ≥ 100, refer to Table A-2.
3. The Report format depends on the Report Type. Refer to Table A-35.

Discussion:

READ BLOCK OUTPUT allows the host to read the output of any block in a module, even though the block does not generate exception reports. The block does not need to be established in the CIU point table. This command is not recommended for normal process I/O. It does not conform to the exception reporting scheme and is inefficient for the host.

The reply is delayed until the module responds to the CIU.

NETWORK 90 Effect:

The CIU sends a Read Block Output message to the module and expects a reply.

READ COMMAND EXCEPTIONS

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	58
Key	2	byte	0
No. to Return	3	byte	V1: 0..214 ^{Note 1}

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	(Table 9-1)
No. returned	2	byte	V2: 0..214 ^{Note 2}
Index 1	3..4	integer	
Command Code 1	5	byte	^{Note 3}
Status 1	6	byte	^{Note 4}
Value 1	7..9	analog	^{Note 5}
Index 2	10..11	integer	
...	≤ 1500*		

*For NCIU02/03, the maximum is 499.

NOTES:

1. This command can read up to 214 (71 with NCIU02/03) points where, $0 \leq V1 \leq 214$ (71 with NCIU02/03).

2. Refer to Fixed or Variable Length in Section 3.

3. Command code is encoded as follows:

- 0 - Station State command
- 1 - Station Set Point command
- 2 - Station Ratio Index command
- 3 - Station Control Output command
- 4 - RCM command
- 5 - RMSC command

4. Interpret the status field according to the Command Code as follows (CC=):

- 0 Commanded station mode (Table A-11)
- 1-3 Source level of command;
 - 0 - Console, 1 - Host
- 4 RCM command (Table A-16)
- 5 Not used

5. From the Command Code, interpret the value field as follows (CC=):

- 0 Not used
- 1-3 Station parameter commanded value
- 4 Not used
- 5 RMSC commanded value

COMMANDS

Discussion:

READ COMMANDS EXCEPTIONS returns commands received by Station Report and Remote Manual Set Constant (RMSC) report points. In addition, if enabled in *CIU RESET*, commands received by Remote Control Memory report points are read using this command rather than by using *READ EXCEPTIONS*. These points must have been established using *ESTABLISH REPORT*.

If the number of commands the CIU has to report exceeds the maximum reply size, the maximum is returned. The host can issue another *READ COMMAND EXCEPTIONS* to get the remaining commands.

If the CIU has received more than one command for a particular station variable since the previous *READ STATION COMMANDS*, the reply contains the latest value. The host receives no indication of the earlier value.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

READ DATA EXCEPTIONS*

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	63
Key	2	byte	0
Maximum Reports	3	byte	Note 1

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	
No. Returned	2	byte	
Point Type (rpt 1)	3	byte	Note 2
Time Stamp (rpt 1)	--	time stamp	Note 3
Index (rpt 1)	--	integer	
Status/Value (rpt 1)	--	Note 4	
Point Type (rpt 2)	--	byte	
Time Stamp (rpt 2)	--	time stamp	
Index (rpt 2)	--	integer	
Status/Value (rpt 2)	--	Note 4	
:	:	:	
:	:	:	
	1505		

*This command is only available for the NCIU04.

NOTES:

1. The NCIU04 returns reports until:

Case 1: the Maximum Reports limit is reached;

Case 2: the reply buffer is filled; or,

Case 3: there are no more reports to return

If the Maximum Reports limit is specified as 0, reports are returned until either case 2 or 3 occurs.

2. Point types returned by this command are defined in Table A-1. If Bad Quality Alarm Management is enabled in the RES-TART command, the Point Type field will contain a zero (0) if the point has a bad quality status due to failure of its module or node. The Status/Value field is defined in Table A-34 of the Appendix.

COMMANDS

3. The Time Stamp is a six byte value representing the absolute NETWORK 90 system time in milliseconds. The Time Stamp is returned only if option T is specified in the Additional Options byte of RESTART. The Time Stamp can be adjusted for the Wall Clock Offset by specifying the W option in the Additional Options byte.

4. The format of the Status/Value field is dependent on the Point Type field. The Status/Value fields are defined in Table A-32 of the appendix.

Discussion:

This command returns the current status/value of points for which the CIU has received an exception report. In order to receive exception reports for a point, the point must have been established with *ESTABLISH POINT*, and connected with either *CONNECT POINT LIST* or *CONNECT POINT GROUP*. Exception reports are also received if the point was established and connected with *ESTABLISH AND CONNECT POINT*.

Similar commands are *READ EXCEPTIONS*, *READ MISCELLANEOUS STATUS EXCEPTIONS*, and *READ STATION EXCEPTIONS*. However, *READ DATA EXCEPTIONS* returns the Status/Value data without **dummy** fields (to pad each report to the same length). It also returns the Point Type and optionally the Time Stamp (the time that exception occurred).

Please note that the order in which the reports are returned is not necessarily in the same sequence that they occurred. The Time Stamp is the only means to determine the sequence of events.

NETWORK 90 EFFECT:

The remainder of the NETWORK 90 system is unaffected by this command.

READ DATA GROUP*

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	65
Key	2	byte	0
Index (pt 1)	3..4	integer	1..10,000
Index (pt 2)	5..6	integer	1..10,000
:	7..102	:	:

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	
Point Type (pt 1)	2	byte	Note 1
Time Stamp (pt 1)	--	time stamp	Note 2
Status/Value (pt 1)	--	Note 3	
Point Type (pt 2)	--	byte	
Time Stamp (pt 2)	--	time stamp	
Status/Value (pt 2)	--	Note 3	
:	:	:	
:	:	:	
	1505		

*This command is only available with the NCIU04.

NOTES:

1. Point types returned by this command are defined in Table A-1. If Bad Quality Alarm Management is enabled in the **RESTART** command, the Point Type field will contain a zero (0) if the point has a bad quality status due to failure of its module or node. The Status/Value field is defined in Table A-34 of the Appendix.

2. The Time Stamp is a six byte value representing the absolute NETWORK 90 system time in milliseconds. The Time Stamp is returned only if option T is specified in (cont.)the Additional Options byte of **RESTART**. The Time Stamp can be adjusted for the Wall Clock Offset by specifying the W option in the Additional Options byte.

3. The format of the Status/Value field is dependent on the Point Type field. The Status/Value fields are defined in Table A-32 of the appendix.

COMMANDS

Discussion:

This command returns the status/value of up to 50 points in the requested group of indices. Each point in the group must have been established with *ESTABLISH POINT* and connected with *CONNECT POINT LIST* or *CONNECT POINT GROUP*. The point may also have been established and connected with *ESTABLISH AND CONNECT*.

Similar commands are *READ VALUE GROUP*, *READ MISCELLANEOUS STATUS GROUP*, and *READ STATION GROUP*. However, *READ DATA GROUP* returns the Status/Value data without **dummy** fields (to pad each report to the same length). It also returns the Point Type and optionally the Time Stamp (the time that exception occurred).

NETWORK 90 EFFECT:

The remainder of the NETWORK 90 system is unaffected by this command.

READ DATA LIST*

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	64
Key	2	byte	0
First Index	3..4	integer	1..10,000
Last Index	5..6	integer	Note 1

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	
Point Type (pt 1)	2	byte	Note 2
Time Stamp (pt 1)	--	time stamp	Note 3
Status/Value	--	Note 4	
Point Type (pt 2)	--	byte	
Time Stamp (pt 2)	--	time stamp	
Status/Value (pt 2)	--	Note 4	
:	:	:	
:	:	:	
	1505		

*This command is only available with the NCIU04.

NOTES:

1. First Index $\leq$ Last Index $\leq$ 10,000. The range of indices that can be specified depends on the point types of the indices, and the size of the reply buffer.

2. Point types returned by this command are defined in Table A-1. If Bad Quality Alarm Management is enabled in the *RESTART* command, the Point Type field will contain a zero (0) if the point has a bad quality status due to failure of its module or node. The Status/Value field is defined in Table A-34 of the Appendix.

3. The Time Stamp is a six byte value representing the absolute NETWORK 90 system time in milliseconds. The Time Stamp is returned only if option 'T' is specified in the Additional Options byte of *RESTART*. The Time Stamp can be adjusted for the Wall Clock Offset by specifying the 'W' option in the Additional Options byte.

COMMANDS

4. The format of the Status/Value field is dependent on the Point Type field. The Status Value fields are defined in Table A-32 of the appendix.

Discussion:

This command returns the status/value of points in the requested list. Each point in the list must have been established with *ESTABLISH POINT* and connected with *CONNECT POINT GROUP* or *CONNECT POINT LIST*. The point may also have been established and connected with *ESTABLISH AND CONNECT*.

Similar commands are *READ VALUE LIST*, *READ MISCELLANEOUS STATUS LIST*, and *READ STATION LIST*. However, *READ DATA LIST* returns the Status/Value data without **dummy** fields (to pad each report to the same length). It also returns the Point Type and optionally the Time Stamp (the time that exception occurred).

NETWORK 90 EFFECT:

The remainder of the NETWORK 90 system is unaffected by this command.

READ DATA SPECS*

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	66
Key	2	byte	0
No. Requested	3	byte	Note 1

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	
No. Requested	2	byte	
Point Type (pnt 1)	3	byte	
Index (pnt 1)	--	integer	
Specs (pnt 1)	--	Note 2	
Point Type (pnt 2)	--	byte	
Index (pnt 2)	--	integer	
Specs (pnt 2)	--	Note 2	
:	:	:	
	1505		

*This command is only available with the NCIU04.

NOTES:

- The NCIU04 returns specifications until:
 - Case 1: the Number Requested limit is reached;
 - Case 2: the reply buffer is filled; or,
 - Case 3: there are no more specifications to return

If the Number Requested limit is specified as 0, specifications are returned until case 2 or 3 occurs.

- The format of the SPECS field is dependent on the Point Type field. The SPECS fields are defined in Table A-33 of the appendix.

Discussion:

READ DATA SPECS provides the host with point specification information. The point's module returns this information after the CIU establishes an exception report route. This command is optional. If the host never uses it, it does not degrade the operation of the CIU.

COMMANDS

Specifications are reported for station variables PV and SP, and for single station points. They do not apply to station status or the other station variables.

Specifications arrive unpredictably. *ESTABLISH POINT* causes the point's module to send specifications to the CIU. If the module is not executing at the time, it sends the specifications when it does execute. The module also sends specifications whenever they change.

The CIU saves a limited number of specifications. To avoid losing any, the host should read specifications after establishing each input point. If all the required specifications have not been read after establishing all points, the host should periodically read specifications during its ongoing I/O processing.

Specifications are lost because the host used CIU memory to established points, or because specification information from NETWORK 90 modules has filled the CIU memory. When the CIU loses a specification, it discards all outstanding specifications, but notes which points have lost them. The CIU replies to the next *READ DATA SPECS* with a NAK, indicating specifications have been discarded. The host can determine points with lost specifications by reading the CIU problem report.

READ DATA SPECS has a bit in the Work Flag which can be read with *READ WORKFLAG*. The bit can also be read by selecting the *RESTART* option that returns the Work Flag for each reply. The RS Work Flag bit is set if *READ DATA SPECS* needs to be issued.

Similar commands are *READ EXCEPTION REPORT SPECS* and *READ STATION SPECS*. *READ DATA SPECS* returns specifications for all the point types covered by these two commands. However, the specifications return without **dummy** fields (to pad each point's specifications to the same length).

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

READ DEFAULT BLOCK

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	15
Key	2	byte	0..32 Note 1
Ring*	3	byte	1..250
Node*	4	byte	1..250
Module	5..6	integer	0..31
Block	7..8	integer	0..65535
Function code	9..10	integer	0..255

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	Note 2
Block	2..110	bytes	Note 3

*For NCIU02/03, Ring and Node are replaced by:

PCU	3..4	integer	1..63
-----	------	---------	-------

NOTES:

1. Refer to Key Field in Section 3.
2. Reply codes < 100, refer to Table 9-1.
Reply codes ≥ 100, refer to Table A-2.
3. Refer to Section 6 - PCU Configuration.

Discussion

READ DEFAULT BLOCK returns the block specification and default parameter values for the given block and corresponding function code. Block number and function code are checked for compatibility. Refer to Section 6 - **PCU Configuration**. The module must be in the configure mode. This command does not use the CIU point table.

NETWORK 90 Effect:

The CIU sends a *Read Default Block* message to the module and expects a reply.

COMMANDS

READ EXCEPTION REPORT SPECS

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	24
Key	2	byte	0
No. to return *	3	byte	V1:0..100 <i>Note 1</i>

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)
No. Returned*	2	byte	V2:0..100 <i>Note 1</i>
Index (spec 1)**	3..4	integer	1..10,000
Field A (spec 1)	5	byte	<i>Note 2</i>
Field B (spec 1)	6..8	analog	<i>Note 2</i>
Field C (spec 1)	9..11	analog	<i>Note 2</i>
Field D (spec 1)	12..14	analog	<i>Note 2</i>
Field E (spec 1)	15..17	analog	<i>Note 2</i>
Index (spec 2)**	18..19	integer	1..10,000
...	20..1502***		

* For NCIU02/03, V1,V2: 0..33

** For NCIU02, Value: 1..2,500

For NCIU03, Value: 1..5,000

*** For NCIU02/03, Binary Char. No: 20..497

NOTES:

1. V1 = zero requests variable length reply. Refer to Fixed or Variable Length Replies in Section 3.

2. Information in fields A through E depends upon the point type according to the Table 2-2.

Discussion:

READ EXCEPTION REPORT SPECS provides the host with point specification information. The point's module returns this information after the CIU establishes an exception report route. This command is optional. If the host never uses it, it does not degrade the operation of the CIU.

Specifications are reported for station variables PV and SP. They do not apply to station status or the other station variables.

Specifications arrive unpredictably. *ESTABLISH POINT* causes the point's module to send specifications to the CIU. If the module is not executing at the time, it sends the

Table 2-2. Report Specification Types for Fields A-E

Field	PV	SP	Analog	Digital	RCM	RMSC
A	E.U.	E.U.	E.U.	Alarm Spec.	Switch type (Table A-16)	E.U.
B	Zero	Zero	Zero	0.0	0.0	Low Limit
C	Span	Span	Span	0.0	0.0	H.Lim.- L.Lim.
D	High Alarm	Dev. Alarm	High Alarm	0.0	0.0	High Limit
E	Low Alarm	0.0 Alarm	Low Alarm	0.0	0.0	Low Limit
Where: E.U. = Engineering Units (refer to Table A-3) Alarm Spec. = Digital alarm specifications (refer to Table A-4)						

specifications when it does execute. The module also sends specifications whenever they change.

The CIU saves a limited number of specifications. To avoid losing specifications, the host should read specifications after establishing each input point. If all the required specifications have not been read after establishing all points, the host should periodically read specifications during its ongoing I/O processing.

Specifications are lost either because the host used CIU memory to established points, or because specification information from NETWORK 90 modules has filled the CIU memory. When the CIU loses a specification, it discards all outstanding specifications, but notes which points have lost them. The CIU replies to the next *READ EXCEPTION REPORT SPECS* with a NAK, indicating specifications have been discarded. The host can determine points with lost specifications by reading the CIU problem report.

Specifications for Single Index Station Read points can be read with *READ STATION SPECS*. Both *READ SPECS* and *READ STATION SPECS* share a common bit in the work flag. The RS work flag bit is set if either *READ SPECS* or *READ STATION SPECS* needs to be issued. Specifications may also be read using the *READ DATA SPECS* command.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

COMMANDS

READ EXCEPTIONS

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	8
Key	2	byte	0
No. of reports	3	byte	V1: 0..250 <i>Note 1</i>

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)
No. Returned	2	byte	V2: 1..250 <i>Note 1</i>
Index (pt 1)*	3..4	integer	1..10,000
Status (pt 1)	5	byte	<i>Note 2</i>
Value (pt 1)	6..8	analog	<i>Note 3</i>
Index (pt 2)*	9..10	integer	1..10,000
...	11..1502**		

* For NCIU02, Value: 1..2,500

For NCIU03, Value: 1..5,000

** For NCIU02/03, Binary Char. No: 11..494

NOTES:

1. V1 = 0 requests variable length reply, (refer to the **Fixed or Variable Length Replies** paragraph in the Section 3). For NCIU02/03, V1: 0..82

2. Each analog exception (including station PV, SP, CO and ratio) returns a status as described in Table A-6, followed by the point value.

Each digital exception returns a status as shown in Table A-7, followed by a dummy value field of zero.

In NCIU02/03 mode, an RCM report may be returned only if the option to separate incoming commands from incoming exceptions, is selected in the *RESTART* command. In NCIU04 mode, *READ EXCEPTIONS* does not return RCM reports.

Each RCM report (Point Type 16) returns a status as described in Table A-15 followed by a dummy value field of zero when an OIU, MCS, or another CIU has issued a set or reset command.

Each RMSC read returns a status as described in Table A-5 followed by the point value.

3. REAL(4) Analog values are returned in REAL(3) format.

Discussion:

READ EXCEPTIONS returns the current status and value of each station variable to be read, or an analog, digital, or RMSC point for which the CIU has received an exception report. In order to receive exception reports for a point, the point must have been established with *ESTABLISH POINT* or *ESTABLISH AND CONNECT POINT*. Normally, the point must have been connected with *CONNECT POINT LIST* or *CONNECT POINT GROUP*, but an exception report arrives for any established exception report if its alarm status changes. After the report of the alarm change, the disconnected point remains disconnected.

READ MISCELLANEOUS STATUS EXCEPTIONS reads station, RCM, and module status.

READ COMMAND EXCEPTIONS is similar except it returns commands received by RMSC and station report types. Note that commands received by RCM report points may alternatively be read with *READ COMMAND EXCEPTIONS* if this option is selected in *CIU RESTART*.

For the NCIU04, *READ DATA EXCEPTIONS* is similar to *READ EXCEPTIONS* except that it also reads miscellaneous status exceptions and station exceptions.

If the number of points the CIU has to report exceeds the maximum reply size, the maximum is returned. The host can issue another *READ EXCEPTIONS* to get the remaining points.

If the CIU has received more than one exception report or RCM value for a particular point since the previous *READ EXCEPTIONS*, the reply contains the latest value. The host receives no indication of the earlier value.

If the exception report screening option selected by *CIU RESTART*, is equal to the value contained in the CIU's data base for the point, incoming exception reports are not sent to the host.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

COMMANDS

READ EXTENDED PROBLEM REPORT

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	46
Key	2	byte	0..32 ^{Note 1}
Ring*	3	byte	1..250
Node*	4	byte	1..250
Module	5..6	integer	0..31
Extended Code	7..8	integer	V1 ^{Note 2}
Block	9..10	integer	0..65535
Report Number	11..14	long	V2 ^{Note 3}

*For NCIU02/03, Ring and Node are replaced by:

PCU	3..4	integer	1..63
-----	------	---------	-------

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	^{Note 4}
Report Number	2..5	long	V5 ^{Note 3}
Report Count	6	byte	V4 ^{Note 5}
Report	7.. ^{Note 6}	bytes	^{Note 7}

NOTES:

1. Refer to Key Field in Section 3.
2. The extended code identifies the type of the extended problem report being requested. V1 = 80FE (HEX) specifies Sequence of Events data, V1 = 8000 (HEX) specifies Extended Module Problem Report data.
3. The complete report from a module may require more than one *READ EXTENDED PROBLEM REPORT*. The host and the module use report number to coordinate the multiple commands. When asking for a new report, the host should issue V2 = 0. The host should request further segments of the report by issuing V5 as the report number.
4. Reply codes < 100, refer to Table 9-1;
Reply codes ≥ 100, refer to Table A-2.
5. For Sequence of Events data, $0 \leq V4 \leq 15$; the number of Sequence of Events Recorder (SER) points contained by V5. Each SER point has 7 bytes of associated data. Otherwise, this is the first byte of the Extended Module Problem Report.
6. Maximum reply length:
116 bytes for CIU02/03 mode
1505 bytes for the local CIU in CIU04 mode
7. Refer to Section 5 - System Status Monitoring.

Discussion:

READ EXTENDED PROBLEM REPORT allows the host to read an extended module problem report. Section 5, **System Status Monitoring**, discusses the use of extended problem reports.

NETWORK 90 Effect:

The CIU sends a Read Extended Problem report to the module and expects a reply.

COMMANDS

READ MISCELLANEOUS STATUS EXCEPTIONS

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	22
Key	2	byte	0
No. to return	3	byte	V1: 0..214 Note 1

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)
No. returned	2	byte	V1: 0..214
Index (pt 1)*	3..4	integer	0..10,000
Status (pt 1)	5..9	bytes	Note 2
Index (pt 2)*	10..11	integer	0..10,000
...	12..1500**		

* For NCIU02, Value: 0..2,500

For NCIU03, Value: 0..5,000

** For NCIU02/03, Binary Char. No: 12..499

NOTES:

1. V1 = zero requests variable length reply. (Refer to Fixed or Variable Length Replies in Section 3).

2. Each Status that returns is described in Table A-8. Each Station Status returns the PV status in the format described in Table A-5. This is followed by Station Status as described in Table A-7 and followed by three zero bytes.

Each RCM read (Point Type 15) returns a status described in Table A-15.

Discussion:

READ MISCELLANEOUS STATUS EXCEPTIONS returns the current status of each station, RCM, and module for which the CIU has received an exception report. In order to receive exception reports for station status, RCM, or module status, the status must have been established as a point with **ESTABLISH POINT** or **ESTABLISH AND CONNECT POINT**. Station status points must normally be connected with **CONNECT POINT LIST** or **CONNECT POINT GROUP**, but a station status exception report always arrives if the station's alarm status changes. Module status is automatically connected.

READ DATA EXCEPTIONS (NCIU04 only) is similar to **READ MISCELLANEOUS STATUS EXCEPTIONS**, but it reads the status, value, and miscellaneous status of all input points.

READ EXCEPTIONS is similar to *READ MISCELLANEOUS STATUS EXCEPTIONS*, but it reads the status and value of analog and digital points. If the number of points the CIU has to report exceeds the maximum reply size, the maximum is returned. The host can issue another *READ MISCELLANEOUS STATUS EXCEPTIONS* to get the remaining points.

If the CIU has received more than one exception report for a particular point, since the previous *READ MISCELLANEOUS STATUS EXCEPTIONS*, the reply contains the latest status. The host receives no indication of the earlier status.

If you select the exception report screening option in *CIU RESTART*, incoming exception reports, equal to the point value contained in the CIU data base, are not sent to the host.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

COMMANDS

READ MISCELLANEOUS STATUS GROUP

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	39
Key	2	byte	0
Index (pt 1)*	3..4	integer	0..10,000 ^{Note 1}
Index (pt 2)*	5..6	integer	0..10,000 ^{Note 1}
...	7..102		

*For NCIU02, Index range: 1..2,500
For NCIU03, Index range: 1..5,000.

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)
Status (pt 1)	2..6	5 bytes	^{Note 2}
...	7..251		

NOTES:

1. A maximum of 50 indices can be read per group. If the command code and key are the only fields issued the CIU will read the value of the last group of indices downloaded by this command.

2. Each module status returned is described in Table A-8.

Each station status returns the PV in the format described in Table A-5. This is followed by a status as in Table A-7, followed by three zero bytes.

Each RCM read (Point Type 15) returns the status described in Table A-15.

Each Single Index Station Read (Point Type 17) returns a status as follows:

BYTE	STATUS	TABLE
1	Station Status	A-6
2	Reply to most recent Station Status write	9-1
3	Reply to most recent Set Point write	9-1
4	Reply to most recent Ratio Index write	9-1
5	Reply to most recent Control Output write	9-1

Discussion:

READ MISCELLANEOUS STATUS GROUP returns the status of stations, RCMs, and modules in the request group of indices. Each point greater than 0 in the group must have been established as a station, RCM read, or module status with **ESTABLISH POINT**.

Point index 0 is automatically established as the module status of the CIU.

For current status, the stations must have been connected with *CONNECT POINT LIST* or *CONNECT POINT GROUP*. Module status need not be connected explicitly.

The CIU remembers the last group of indices downloaded by this command. If the command code and key are the only fields issued, the remembered group of indices is used to formulate the reply.

Similar commands are *READ DATA LIST* (NCIU04 only), *READ VALUE LIST*, and *READ STATUS LIST* which return data from analog and digital points.

The additional use of this command to check the progress of writes to Single Index Station Read (Point Type 17) points is discussed in *Station Control* in Section 4.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

COMMANDS

READ MISCELLANEOUS STATUS LIST

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	21
Key	2	byte	0
First Index*	3..4	integer	V1: 0..10,000
Last Index	5..6	integer	V2 ^{Note 1}

* For NCIU02, V1: 0..2,500
For NCIU03, V1: 0..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)
Status (pt 1)	2..6	5 bytes	^{Note 2}
...	7..1506		^{Note 3}

NOTES:

1. This command can read up to 301 (99 for NCIU02/03) points where:

$$V1 \leq V2 \leq V1 + (0..98) \text{ 10,000 (5,000 for NCIU03, 2,500 for NCIU02)}$$

2. Module Status is described in Table A-8. Station status returns PV status in the format described in Table A-5. This is followed by station status described in Table A-7, and followed by three zero bytes.

Each RCM read (Point Type 15) returns a status described in Table A-15.

3. For point types see Table A-1.

Each Single Index Station Read (Point Type 17) returns a status as follows:

BYTE	Status	Table
1	Station Status	A-6
2	Reply to most recent Station Status write	9-1
3	Reply to most recent Set Point write	9-1
4	Reply to most recent Ratio Index write	9-1
5	Reply to most recent Control Output write	9-1

Discussion:

READ MISCELLANEOUS STATUS LIST returns the status of stations, RCMs, and modules for the request list. Each point with an index greater than 0 in the list must have been established as a station, RCM read, or module status with *ESTABLISH POINT* or *ESTABLISH AND CONNECT POINT*.

Point index 0 is automatically established as the module status of the CIU. For current status, the stations must have been connected with *CONNECT POINT LIST* or *CONNECT POINT GROUP*. Module status need not be connected.

Similar commands are *READ DATA LIST* (NCIU04 only), *READ VALUE LIST* and *READ STATUS LIST* which return data from analog and digital points. Additionally, using this command to check the progress of writes to Single Index Station Read (Point Type 17) is discussed in **Station Control** (Section 4).

NETWORK 90 EFFECT:

The remainder of the NETWORK 90 system is unaffected.

COMMANDS

READ NEXT BLOCK

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	14
Key	2	byte	0..32 ^{Note 1}
Ring*	3	byte	1..250
Node*	4	byte	1..250
Module	5..6	integer	0..31
Prior Block	7..8	integer	0..65535

For NCIU02/03, Ring and Node are replaced by:

PCU	3..4	integer	1..63
-----	------	---------	-------

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	^{Note 2}
Block	2..3	integer	
Block data	4..112	bytes	^{Note 3}

NOTES:

1. Refer to **Key Field** in Section 3.
2. Reply codes < 100, refer to Table 9-1.
Reply codes ≥ 100, refer to Table A-2.
3. Refer to Section 6 - PCU Configuration.

Discussion:

READ NEXT BLOCK reads the block configured with the nearest block number greater than V1 in a NETWORK 90 Module. Refer to Section 6 - **PCU Configuration**. Note that block configuration can only be read while the module is in configure or execute mode.

This command does not use the CIU point table.

NETWORK 90 Effect:

The CIU sends a Read Next Block message to the module and expects a reply.

READ PROBLEM REPORT

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	26
Key	2	byte	Note 1
Ring*	3	byte	1..250
Node*	4	byte	1..250
Module	5..6	integer	0..31
Report number	7..8	integer	Note 2

*For NCIU02/03, Ring and Node are replaced by:

PCU	3..4	integer	1..63
-----	------	---------	-------

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	Note 3
Report number	2..3	integer	Note 2
Report	4..Note 4	bytes	Note 5

NOTES:

1. Key is 0..32 for modules, 0 for CIU. Refer to **Key Field** in Section 3.
2. The complete report from a module may require more than one *READ PROBLEM REPORT*. The host and the module use report number to coordinate the multiple commands. When asking for a new report, the host should issue V1 = 0. The computer should request further segments of the report, by issuing V1 as the report number returned by the module in the previous *READ PROBLEM REPORT*.
3. Reply codes < 100, refer to Table 9-1.
Reply codes ≥ 100, refer to Table A-2.
4. The maximum reply length:
116 bytes for NCIU02/03
1505 bytes for the NCIU04
5. Refer to Section 5 - **System Status Monitoring**.

Discussion:

READ PROBLEM REPORT allows the host to read a module problem report of any module or of the CIU. The System Status Monitoring Section discusses the use of problem reports. Problem reports for Superloop modules (SSM, SBM, BCM) must be read using *READ EXTENDED PROBLEM REPORT*.

COMMANDS

The reply is delayed until the module responds to the CIU.

NETWORK 90 Effect:

The CIU sends a read problem report message to the module and expects a reply.

READ STATION EXCEPTIONS

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	53
Key	2	byte	0
No. to Return*	3	byte	V1: 0..93 Note 1

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	Table 9-1
No. Returned*	2	byte	V2: 0..93 Note 2
Index	3..4	integer	(Table A-5)
Quality Status	5	byte	
PV Value	6..8	analog	
SP Value	9..11	analog	
CO Value	12..14	analog	(Table A-7)
RI Value	15..17	analog	
Mode Status	18	byte	
Index	19..20	integer	
...	21..1490**		

* For NCIU02/03, V1 and V2: 0..31

**For NCIU02/03, V1 and V2: 21..498

NOTES:

1. V1 = zero requests variable length reply. Refer to **Fixed or Variable Length Replies** in Section 3.

2. This field contains the number of station exceptions that were returned. If the number returned is equal to the number requested, or equal to the maximum, there may be more station exceptions to be read.

Discussion:

READ STATION EXCEPTIONS returns the current status and value of each Single Index Station Read (Type 17) point for which the CIU has received an exception report. In order to receive exception reports for a point, it must have been established with **ESTABLISH POINT**. Normally, the point must have been connected with **CONNECT POINT LIST** or **CONNECT POINT GROUP**, but an exception report arrives for any established point if its alarm status changes. After the report of the alarm change, the disconnected point remains disconnected.

COMMANDS

Similar commands are *READ DATA EXCEPTIONS* (NCIU04, only), *READ MISCELLANEOUS STATUS EXCEPTIONS*, *READ EXCEPTIONS*, and *READ STATUS LIST*. *READ MISCELLANEOUS STATUS EXCEPTIONS* returns station status bytes for Station Status (Type 6) points. It also returns module and RCM read status.

READ EXCEPTIONS is used for reading analog exceptions (including PV, SP, CO, and ratio exceptions of stations established as Point Types 1, 2, 3, and 4), digital exceptions, and RCM reports (Point Type 16). *READ STATUS LIST* returns a General Message Interface (GMI) reply byte indicating the progress of a station variable write (refer to **Station Control** in Section 4).

If the number of points the CIU has to report exceeds the maximum reply size, the maximum reply size is returned. The host can issue another *READ STATION EXCEPTIONS* to get the remaining points.

If the CIU has received more than one exception report for a particular point since the previous *READ EXCEPTIONS*, the reply contains the latest value. The host receives no indication of the earlier value.

If the exception report screening option was selected by *CIU RESTART*, incoming exception reports, equal to the value contained in the CIU data base for the point, are not sent to the computer.

NETWORK 90 Effect:

The remainder of the NETWORK 90 System is unaffected.

READ STATION GROUP

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	55
Key	2	byte	0
Index 1*	3..4	integer	1..10,000 Note 1
Index 2*	5..6	integer	1..10,000 Note 1
...	7..72		

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	(Table 9-1)
Quality Status 1	2	byte	(Table A-5)
PV Value 1	3..5	analog	
SP Value 1	6..8	analog	
CO Value 1	9..11	analog	
RI Value 1	12..14	analog	
Mode Status 1	15	byte	(Table A-7)
Quality Status 2	16	byte	(Table A-5)
...	17..701**		

* For NCIU02, Index range: 1..2,500

** For NCIU03, Index range: 1..5,000

** For NCIU02/03, 17..491

NOTE:

1. A maximum of 50 (35 for NCIU02/03) indices can be read per group. If the Command Code and Key are the only fields issued the CIU reads the values of the last group of indices downloaded by this command.

Discussion:

READ STATION GROUP returns the values of the station status bytes, and the four station variables for all stations in the requested list. Every index in the list must have been established as a Single Index Station Read (Type 17) point with *ESTABLISH POINT*. In order for the values to be current, each point must have been connected with *CONNECT POINT LIST* or *CONNECT POINT GROUP*.

The CIU remembers the last group of indices downloaded by the command. If the Command Code and Key are the only fields issued, the remembered group of indices is used to formulate the reply.

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Similar commands are *READ DATA LIST* (NCIU04, only), *READ DATA GROUP* (NCIU04, only), *READ STATION LIST*, *READ STATUS LIST*, *READ STATUS GROUP*, *READ VALUE LIST*, and *READ VALUE GROUP*. *READ STATION LIST* returns the status and values as above for stations at sequential indexes. *READ STATUS LIST* returns status, but not analog values. *READ MISCELLANEOUS STATUS LIST* and *READ MISCELLANEOUS STATUS GROUP* return the status of stations, RCMs, and modules. *READ DATA LIST* and *READ DATA GROUP* return the station status and value bytes, and other input point types.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

READ STATION LIST

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	54
Key	2	byte	0
First index*	3..4	integer	V1: 1..10,000
Last Index	5..6	integer	V2 ^{Note 1}

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	(Table 9-1)
Quality Status	2	byte	(Table A-5)
PV Value 1	3..5	analog	
SP Value 1	6..8	analog	
CO Value 1	9..11	analog	
RI Value 1	12..14	analog	
Mode Status 1	15	byte	
Quality Status 2	16	byte	(Table A-5)
...	17..1499**		

* For NCIU02, V1: 1..2,500

For NCIU03, V1: 1..5,000

** For NCIU02/03, Binary Char. No: 17..491

NOTE:

1. For NCIU04, this command can read up to 100 points where:
 $V1 \leq V2 \leq V1 + (0..100) \leq 10,000$.

For NCIU03, this command can read up to 35 points where:
 $V1 \leq V2 \leq V1 + (0..35) \leq 5,000$.
 (For NCIU02, V2: 1..2,500)

Discussion:

READ STATION LIST returns the values of the station status bytes, and of all four station variables for all stations in the requested list. Every index in the list must have been established as a Single Index Station Read (Type 17) point with *ESTABLISH POINT*. In order for the values to be current, each point must have been connected with *CONNECT POINT LIST* or *CONNECT POINT GROUP*.

Similar commands are *READ DATA LIST* (NCIU04, only), *READ DATA GROUP* (NCIU04, only), *READ STATION GROUP*, *READ STATUS LIST*, *READ STATUS GROUP*, *READ VALUE LIST*, and *READ VALUE GROUP*. *READ STATION GROUP* returns the status and values as above for stations that are not at sequential indexes. *READ STATUS LIST* returns status,

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but not analog values. *READ MISCELLANEOUS STATUS LIST* and *READ MISCELLANEOUS STATUS GROUP* return the status of stations, RCMs, and modules. *READ DATA LIST* and *READ DATA GROUP* return the station status and value bytes, and other input point types.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

READ STATION LIST

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	54
Key	2	byte	0
First index*	3..4	integer	V1: 1..10,000
Last Index	5..6	integer	V2 ^{Note 1}

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	(Table 9-1)
Quality Status	2	byte	(Table A-5)
PV Value 1	3..5	analog	
SP Value 1	6..8	analog	
CO Value 1	9..11	analog	
RI Value 1	12..14	analog	
Mode Status 1	15	byte	
Quality Status 2	16	byte	(Table A-5)
...	17..1499**		

* For NCIU02, V1: 1..2,500

For NCIU03, V1: 1..5,000

** For NCIU02/03, Binary Char. No: 17..491

NOTE:

1. For NCIU04, this command can read up to 100 points where:
 $V1 \leq V2 \leq V1 + (0..100) \leq 10,000$.

For NCIU03, this command can read up to 35 points where:
 $V1 \leq V2 \leq V1 + (0..35) \leq 5,000$.
 (For NCIU02, V2: 1..2,500)

Discussion:

READ STATION LIST returns the values of the station status bytes, and of all four station variables for all stations in the requested list. Every index in the list must have been established as a Single Index Station Read (Type 17) point with *ESTABLISH POINT*. In order for the values to be current, each point must have been connected with *CONNECT POINT LIST* or *CONNECT POINT GROUP*.

Similar commands are *READ DATA LIST* (NCIU04, only), *READ DATA GROUP* (NCIU04, only), *READ STATION GROUP*, *READ STATUS LIST*, *READ STATUS GROUP*, *READ VALUE LIST*, and *READ VALUE GROUP*. *READ STATION GROUP* returns the status and values as above for stations that are not at sequential indexes. *READ STATUS LIST* returns status,

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but not analog values. *READ MISCELLANEOUS STATUS LIST* and *READ MISCELLANEOUS STATUS GROUP* return the status of stations, RCMs, and modules. *READ DATA LIST* and *READ DATA GROUP* return the station status and value bytes, and other input point types.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

READ STATION SPECS

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	52
Key	2	byte	0
No. to Return*	3	byte	V1: 0..68 ^{Note 1}

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)
No. Returned	2	byte	V2: 0..68
Index 1***	3..4	integer	
Eng. Units 1	5	byte	
High Alarm 1	6..8	analog	
Low Alarm 1	9..11	analog	
Dev. Alarm 1	12..14	analog	
PV & SP Span 1	15..17	analog	
PV Zero 1	18..20	analog	
SP Zero 1	21..23	analog	
Station Type 1	24	byte	(Table A-17)
Index 2	25..26	integer	
...	27..1498**		

* For NCIU02/03, Value: 0..22

** For NCIU02/03, Binary Char. No: 0..486

*** For NCIU02, Index range: 1..2,500

For NCIU03, Index range: 1..5,000

NOTES:

1. V1 = zero requests variable length reply, (refer to **Fixed or Variable Length Replies** in Section 3.

2. V2 = 0 to V1, If V1 $\neq$ 0; If V1 = 0, range is 0 - 68

Discussion:

READ STATION SPECS provides the host with Single Index Station Read (Type 17) point specification information. The module of the point returns this information after the CIU establishes an exception report route. This command is optional. If the host never uses it, it does not degrade CIU operation.

Station specifications may also be read by *READ DATA SPECS* (NCIU04 only). Specifications for point types other than Single Index Station Read may be read by *READ SPECS*.

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READ DATA SPECS, *READ SPECS*, and *READ STATION SPECS* share a common bit in the work flag. This may be read using *READ WORK FLAG*. The RS work flag bit is set if *READ DATA SPECS*, *READ SPECS* or *READ STATION SPECS* needs to be sent.

Specifications arrive unpredictably. *ESTABLISH POINT* causes the point's module to send specifications to the CIU. If the module is not executing at the time, it sends the specifications when it does execute. The module also sends specifications whenever they change.

The CIU saves a limited number of specifications. To avoid losing specifications, the host should read them after each input point is established. If all the required specifications are not read after all the points have been established, the host should periodically read specifications during its ongoing I/O processing.

Specifications are lost either because the host used CIU memory to establish points, or specification information from NETWORK 90 modules has filled the CIU memory. When the CIU loses a specification, it discards all outstanding ones, but notes which points have lost them. The CIU replies to the next *READ STATION SPECS* with a NAK indicating that specifications have been discarded. The host can determine points for which specifications were lost by reading the CIU problem report.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

READ STATUS GROUP

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	38
Key	2	byte	0
Index (pt 1)*	3..4	integer	1..10,000 Note 1
Index (pt 2)*	5..6	integer	1..10,000 Note 1
...	7..102		

* For NCIU02, Index range: 1..2,500.
For NCIU03, Index range: 1..5,000.

Reply:

	Binary Char. No.	Data Type	Field Value
Reply code	1	byte	(Table 9-1)
Status (pt 1)	2	byte	Note 2
...	3..51		

NOTES:

1. A maximum of 50 indices can be read per group. If the command code and key are the only fields issued, the CIU reads the value of the last group of indices downloaded by this command.

2. Each station variable or analog input returns a status in the format described in Table A-5. Each digital input point returns a status in the format described in Table A-6. Each station variable to be written returns a module bus reply in the format described in Table A-2.

Discussion:

READ STATUS GROUP returns the status of the station variable, and analog and digital points in the requested group of indices. The command provides digital point data without dummy analog fields. It also indicates the progress of a station variable write. Each point in the group must have been established either as a station variable to be read, or as an analog or digital input with *ESTABLISH POINT*. In order for the values to be current, each point must have been connected with *CONNECT POINT LIST* or *CONNECT POINT GROUP*.

The CIU remembers the last group of indices downloaded by this command. If the command code and key are the only fields issued, the remembered group of indices is used to formulate the reply.

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Similar commands are *READ VALUE LIST* and *READ VALUE GROUP* which return analog point values and status, as well as station variable values and status. In addition, *READ MISCELLANEOUS VALUE LIST* and *READ MISCELLANEOUS VALUE GROUP* return the status of stations, RCMs, and modules. *READ STATION LIST* and *READ STATION GROUP* return station variable values and station status for points established as Single Index Station Read (Point Type 17).

The additional use of this command to check progress of a station write is discussed in Station Control in Section 4.

NETWORK 90 EFFECT:

The remainder of the NETWORK 90 system is unaffected.

READ STATUS LIST

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	7
Key	2	byte	0
First index*	3..4	integer	V1: 1..10,000
Last index	5..6	integer	V2 ^{Note 1}

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)
Status (pt 1)	2	byte	^{Note 2}
...	3..1506**		

* For NCIU02, V1: 1..2,500

For NCIU03, V1: 1..5,000

** For NCIU02/03, Binary Char. No: 3..499

NOTES:

1. For NCIU04, this command can read up to 1505 points where,
 $V1 \leq V2 \leq V1 + (0..1504) \leq 10,000$.

For NCIU02/03, this command can read up to 498 points where,
 $V1 \leq V2 \leq V1 + (0..498) \leq 5,000$.

2. Each station variable or analog input returns a status of the format described in Table A-5. Each digital input point returns a status of the format described in Table A-6. Each station variable to be written returns a module bus reply in the format described in Table A-2, to indicate the progress of the write.

3. For point types, refer to Table A-1.

Discussion:

READ STATUS LIST returns the status of the station variable, analog, and digital points in the requested list. The command provides digital point data without dummy analog fields. It also indicates the progress of a station variable write. Each point in the list must have been established as a station variable to be read or an analog or digital input with *ESTABLISH POINT*. For current values, each point must have been connected with *CONNECT POINT LIST* or *CONNECT POINT GROUP*.

Similar commands are *READ DATA LIST* and *READ DATA GROUP* (NCIU04), and *READ VALUE LIST* and *READ VALUE GROUP* which return analog values as well as status values. Also *READ MISCELLANEOUS VALUE LIST* and *READ MISCELLANEOUS VALUE GROUP* return the status of stations,

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RCMs, and modules. *READ STATION LIST* and *READ STATION GROUP* commands return values of station variables and status for stations established as Point Type 17 (Table A-1).

Station Control in Section 4 discusses the use of this command to check the progress of Station Variable writes, RCM writes, and RMSC writes.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

READ SYSTEM TIME/DATE

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	43
Key	2	byte	0

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	
Sync'd	2	byte	0..1 Note 1
Year	3..4	integer	0..99
Month	5..6	integer	1..12
Day	7..8	integer	1..31
Day of Week	9..10	integer	1..7
Hour	11..12	integer	0..23
Minute	13..14	integer	0..59
Second	15..16	integer	0..59
Sample number	17..18	integer	0..65535
Time Sync	19	byte	0..250
Master Ring*			
Time Sync	20	byte	0..250
Master Node*			
Time Stamp**	21..26	time stamp	Note 2
Wall Clock**	27..32	time stamp	Note 3
Offset			

* For NCIU02/03, Time Sync Master Ring and Time Sync Master Node are replaced by:

Time Sync Master	19..20	integer	1..63
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** Not available with NCIU02/03

NOTES:

1. Sync'd

- = 0, CIU has not received a Time Sync from the system
- = 1, CIU has received a Time Sync from the system

2. The Time Stamp is a 6 byte value representing the absolute NETWORK 90 system time in milliseconds. The Time Stamp is returned only if NCIU04 was selected in the Options byte of the *RESTART* command.

3. The Wall Clock Offset is a 6 byte, signed value representing the difference between the Time Stamp and the date/time in milliseconds. The Wall Clock Offset is returned only if NCIU04 was selected in the Options byte of *RESTART*.

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Discussion:

READ SYSTEM TIME/DATE returns the system date and time, the ring and node of the Time Sync Master, and the Time Stamp and the Wall Clock Offset.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

READ VALUE GROUP

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	35
Key	2	byte	0
Index (pt 1)*	3..4	integer	1..10,000 Note 1
Index (pt 2)*	5..6	integer	1..10,000 Note 1
...	7..102		

* For NCIU03, Index range: 1..5,000

For NCIU02, Index range: 1..2,500.

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)
Status (pt 1)	2	byte	Note 2
Value (pt 1)	3..5	analog	Notes 2, 3
...	6..201		

NOTES:

1. A maximum of 50 indices can be read per group. If the command code and key are the only fields issued, the CIU reads the value of the last group of indices downloaded by this command.

2. Each station variable or analog input returns a status in the format described in Table A-5, followed by the points value. Each digital point returns a status in the format described in Table A-6, followed by a dummy value field of zero.

3. REAL(4) Analog point values are returned in REAL(3) format.

Discussion:

READ VALUE GROUP returns values of station variables, and analog and digital points in the requested group of indices. Each point in the group must have been established as a station variable to be read, or as an analog or digital input with *ESTABLISH POINT*. In order for the values to be current, each point must have been connected with *CONNECT POINT LIST* or *CONNECT POINT GROUP*.

The CIU remembers the last group of indices downloaded by this command. If the command code and key are the only fields issued, the remembered group of indices is used to formulate the reply.

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Similar commands are *READ STATUS LIST* and *READ STATUS GROUP* which return status, but not analog value. In addition, *READ MISCELLANEOUS STATUS LIST* and *READ MISCELLANEOUS STATUS GROUP* return the status of stations, RCMs, and modules.

READ DATA LIST and *READ DATA GROUP* return status and value.

NETWORK 90 Effect:

The remainder of NETWORK 90 System is unaffected.

READ VALUE LIST

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	6
Key	2	byte	0
First index*	3..4	integer	V1: 1..10,000
Last index	5..6	integer	V2 ^{Note 1}

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)
Status (pt 1)	2	byte	^{Note 2}
Value (pt 1)	3..5	analog	^{Note 3}
...	6..1505**		

* For NCIU02, V1: 1..2,500; For NCIU03, V1: 1..5,000

** For NCIU02/03, 6..497

NOTES:

1. For the NCIU04, this command can read up to 376 points where, $V1 \leq V2 \leq V1 + (0..376) \leq 10,000$.

For NCIU03, this command can read up to 124 points where, $V1 \leq V2 \leq V1 + (0..124) \leq 5,000$ (or 2,500 for NCIU02).

2. Each station variable or analog input returns a status as in Table A-5, followed by the point's value. Each digital point returns a status as in Table A-6, followed by a dummy value field of zero.

3. REAL(4) Analog values are returned in REAL(3) format.

Discussion:

READ VALUE LIST returns the values of the station variable, analog, and digital points in the requested list. Each point in the list must have been established as a station variable to be read, or an analog or digital input with *ESTABLISH POINT*. If the values are to be current, each point must have been connected with *CONNECT POINT LIST/CONNECT POINT GROUP*.

Similar commands are *READ DATA LIST* and *READ DATA GROUP*, *READ STATUS LIST* and *READ STATUS GROUP* which return status, but not values. *READ MISCELLANEOUS STATUS LIST* and *READ MISCELLANEOUS STATUS GROUP* return status of stations, RCMs, and modules.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

COMMANDS

READ WORK FLAG

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	34
Key	2	byte	0
Maximum Wait	3..4	integer	0..65535

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	
Work Flag Byte 1	2	byte	Note 1
Work Flag Byte 2	3	byte	Note 2

NOTES:

1. Each bit of Work Flag Byte 1 corresponds to a particular command that needs to be sent.

Work Flag Byte 1 = RCE + RSE + RST + RS + RE+ RME

where:

RCE = 32 for READ COMMAND EXCEPTIONS
RSE = 16 for READ STATION EXCEPTIONS
RST = 8 for READ SYSTEM TIME/DATE
(CIU has been Time-synched)
RS = 4 for READ EXCEPTION REPORT, SPECS,
READ DATA SPECS, or READ STATION SPECS
RE = 2 for READ EXCEPTIONS
RME = 1 for READ MISCELLANEOUS STATUS EXCEPTIONS

2. Work Flag Byte 2 is returned only with the NCIU04 (refer to *RESTART* command).

Work Flag Byte 2 = DQ + RDE

where:

DQ = 2 for DEQUEUE (or READ PLANT MESSAGE)
RDE = 1 for READ DATA EXCEPTIONS

Discussion:

READ WORK FLAG allows the host to issue a single command to determine other commands needed. After each read, the Work Flag is cleared (set to 0). If you select the option to return the Work Flag with each reply, in *RESTART*, the reply contains two Work Flags. However, the first should be ignored since it is the value of the Work Flag after it has been cleared.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

REGENERATE SPECS

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	28
Key	2	byte	0
Index*	3..4	integer	1..10,000

* For NCIU02, Value: 1..2,500
For NCIU03, Value: 1..5,000

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	(Table 9-1)

REGENERATE SPECS causes a module to send point specification information. Specifications normally are sent by the module when the point is established and when the specifications change. *REGENERATE SPECS* is used only after the specifications have been lost.

When the CIU receives the specifications, the host can read them with *READ SPECS*, *READ STATION SPECS*, and *READ DATA SPECS*.

The point must have been established as a station variable to be read, or as an analog or digital input with *ESTABLISH POINT*.

NETWORK 90 Effect:

The CIU sends an establish message to the PCU containing the block. If the module with the block is executing, the PCU sends exception report specifications to the CIU.

COMMANDS

REREAD REPLY

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	9
Key	2	byte	0

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1..1505*	bytes	V1**

* For NCIU02/03, Binary Char. No: 1..500

**V1 = previous command reply.

Discussion:

REREAD REPLY allows the host recovery from a transmission error in the reply to a command, by requesting the reply again.

NETWORK 90 Effect:

The remainder of the NETWORK 90 system is unaffected.

SET CIU STATUS

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	33
Key	2	byte	0
Status	3	byte	V1: 0..255 ^{Note 1}
Node Type	4	byte	0..7 ^{Note 2}

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	(Table 9-1)
CIU Status	2..17*	bytes	(Table A-8)

*For NCIU02/03, Binary Char. No: 2..6

NOTES:

1. V1 is a status byte written to the fifth status byte of the CIU module status. If V1 is not equal to 0, the CIU will set the error summary bit.

2. The Node Type defines how this LSM/SSM is being used. This value is placed in the third byte of the LSM/SSM Module Status (Table A-8). The default type is CIU (value = 0).

Discussion:

SET CIU STATUS allows the host control of the fifth status byte of the CIU module status.

NETWORK 90 Effect:

The CIU sends one module status exception report to each module with an established route for the CIU module status.

COMMANDS

SET SYSTEM DATE AND TIME

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	60
Key	2	byte	0
Year	3	byte	Note 1
Month	4	byte	1..12
Day	5	byte	1..31
Hour	6	byte	0..23
Minute	7	byte	0..59
Second	8	byte	0..59
Time Zone Difference	9..10	integer	Note 2

Reply:

Field	Binary Char. No.	Data Type	Value
Reply Code	1	byte	(Table 9-1)

NOTES:

1. The year must be within the range 87 to 99 (1987 to 1999), or 0 to 48 (2000 to 2048).
2. The Time Zone Difference is valid in the NCIU04, only. It compensates for the wall clock time difference (in minutes) between system nodes situated in different time zones.

For NCIU02/03, Time Zone Difference is replaced by:

Sample Number	9..10	integer	
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Discussion:

SET SYSTEM DATE AND TIME allows the host to set the NETWORK 90 system time and date, provided time synching was selected in *CIU RESTART*, and, for the NCIU04, at least eight minutes have elapsed since the CIU was restarted (until which time the command is illegal). The CIU synchronizes all system ring nodes. If time synching was not selected in the *CIU RESTART* command, the CIU expects time synching to be done by another node, in which case this command becomes illegal. If no node provides time synching, this command may be used to set the local CIU time and date.

For the NCIU02/03, Sample Number is used by the CIU only if the time synching has been enabled. It is only used the first time *SET SYSTEM TIME AND DATE* is issued.

NETWORK 90 Effect:

If time synching is selected, *SET SYSTEM DATE AND TIME* causes the CIU to time synchronize all system nodes. If time synching is not selected, the rest of the NETWORK 90 system is unaffected.

COMMANDS

TREND DATA POLL

Command:

Field	Binary Char. No.	Data Type	Value
Command code	1	code	48
Key	2	byte	0..32 Note 1
Ring	3	byte	1..250
Node	4	byte	1..250
Module	5..6	integer	0..31
Trend type	7	byte	V1 Note 2
Spare	8	byte	V2 Note 3
Block	9..10	integer	0..65535
Sample number	11..12	integer	V3 Note 4

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	Note 5
Trend type	2	byte	V1 Note 2
Trend mode	3	byte	V4 Note 6
Spare	4	byte	V2 Note 3
Begin sample number	5..6	integer	V5 Note 7
Spare	7	byte	V2 Note 3
Number of samples	8	byte	V6 Note 8
Trend data	9..V7 V7 ≤ 104	REAL(2)	Note 9

* For NCIU02/03, Ring and Node are replaced by:

PCU	3..4	integer	1..63
-----	------	---------	-------

NOTES:

1. Refer to Key Field in Section 3.
2. V1 indicates the trend type:
V1 = 0 indicates a one minute trend.
V1 = 1 indicates a 15 second trend.
3. V2 should be set to zero. It is unused at this time.
4. V3 is the requested trend data sample number. The destination module uses V3 to determine what trend data to send.
5. Reply codes < 100, refer to Table 9-1.
Reply codes ≥ 100, refer to Table A-2.

6. V4 is the trend mode. The following trend modes are defined:

V4 = 0 sample
V4 = 1 mean
V4 = 2 minimum
V4 = 3 maximum
V4 = 4 sum

7. V5 is the beginning sample number of trend data actually sent.

8. V6 is the number of trend data values returned,

$-1 \leq V6 \leq 48$.

V6 = -1 indicates trend data not yet available.

9. V7 represents the REAL(2) trend data values. Format may be changed with the DATA FORMATS command.

Format	V7
REAL(2)	104
REAL(3)	152
REAL(4)	200
REAL(8)	392

Discussion:

TREND DATA POLL allows the host to access distributed trend data from modules.

NETWORK 90 Effect:

The CIU issues a *TREND DATA POLL* message to the module and expects a reply.

COMMANDS

TUNE BLOCK

Command:

Field	Binary Char. No.	Data Type	Value
Command Code	1	code	17
Key	2	byte	0..32 Note 1
Ring*	3	byte	1..250
Node*	4	byte	1..250
Module	5..6	integer	0..31
Block	7..8	integer	0..65535
Function code	9	byte	0..255
Parameter values	10..125	bytes	Note 2

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	Note 3

* For NCIU02/03, Ring and Node are replaced by:

PCU	3..4	integer	1..63
-----	------	---------	-------

NOTES:

1. Refer to Key Field in Section 3.
2. Refer to Section 6 - PCU Configuration.
3. Reply codes < 100, refer to Table 9-1
Reply codes ≥ 100 , refer to Table A-2.

Discussion:

TUNE BLOCK changes the tuning parameters of a block. The module must be in execute mode to change tuning parameters. Refer to Section 6 - PCU Configuration.

NETWORK 90 Effect:

The CIU sends a *TUNE BLOCK* message to the module and expects a reply.

WRITE BLOCK

Command:

Field	Binary Char. No.	Data Type	Value
Command code	1	code	16
Key	2	byte	0..32 Note 1
Ring*	3	byte	1..250
Node*	4	byte	1..250
Module	5..6	integer	0..31
Block	7..8	integer	0..65535
Function code	9	byte	0..255
Parameter values	10..125	bytes	Note 2

Reply:

Field	Binary Char. No.	Data Type	Value
Reply code	1	byte	Note 3

* For NCIU02/03, Ring and Node are replaced by:

PCU	3..4	integer	1..63
-----	------	---------	-------

NOTES:

1. Refer to Key Field in Section 3.
2. Refer to Section 6 - PCU Configuration.
3. Reply codes < 100, refer to Table 9-1.
Reply codes ≥ 100 or greater are defined in Table A-2.

Discussion:

WRITE BLOCK configures or modifies a block in a module within a PCU. The module must be in configure mode. Refer to Section 6 - PCU Configuration.

This command does not use the CIU point table.

NETWORK 90 Effect:

The CIU sends a *WRITE BLOCK* message to the module and expects a reply

COMMANDS

INTRODUCTION

This section details several topics pertaining to more than one command.

PROTOCOL

Application software should be able to use the host's standard I/O service routines to communicate with the CIU. Figures 3-1 and 3-2 are flowcharts of procedures which handle the protocol. Each information transfer is a command from the host followed by a reply from the CIU.

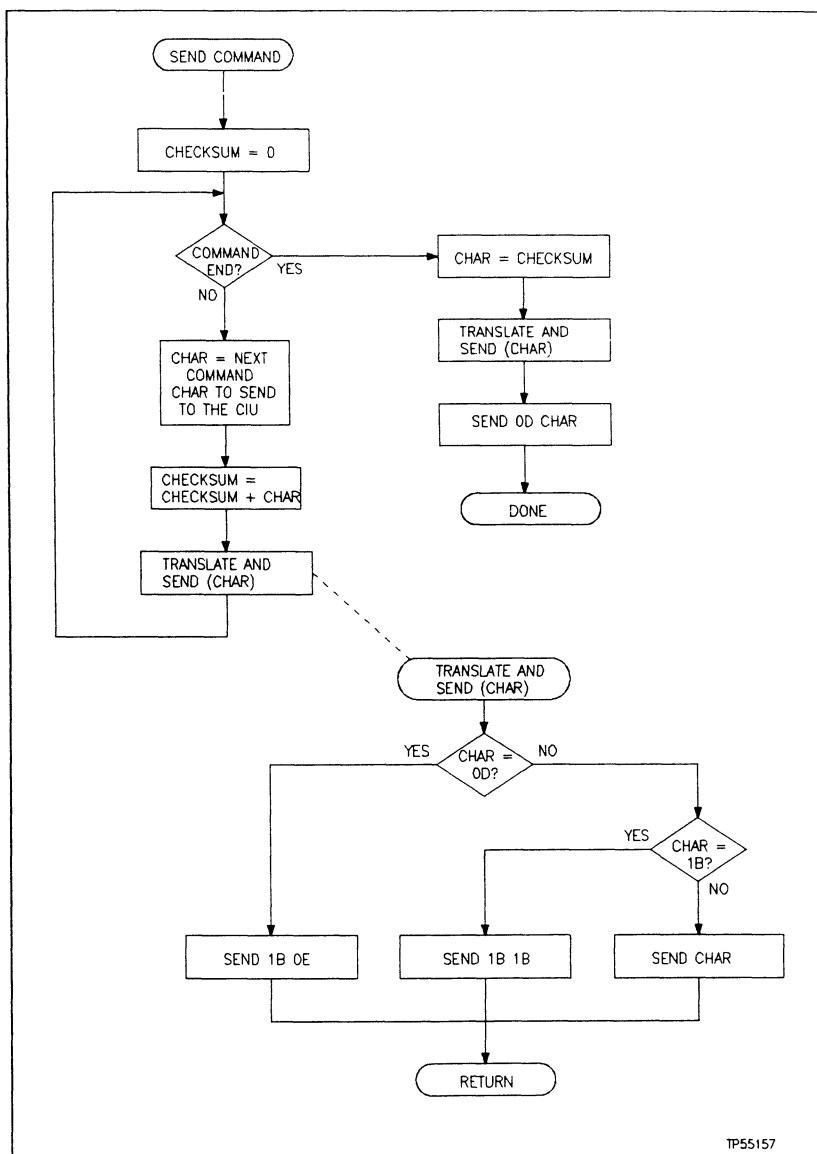


Figure 3-1. Procedure For Sending A Command

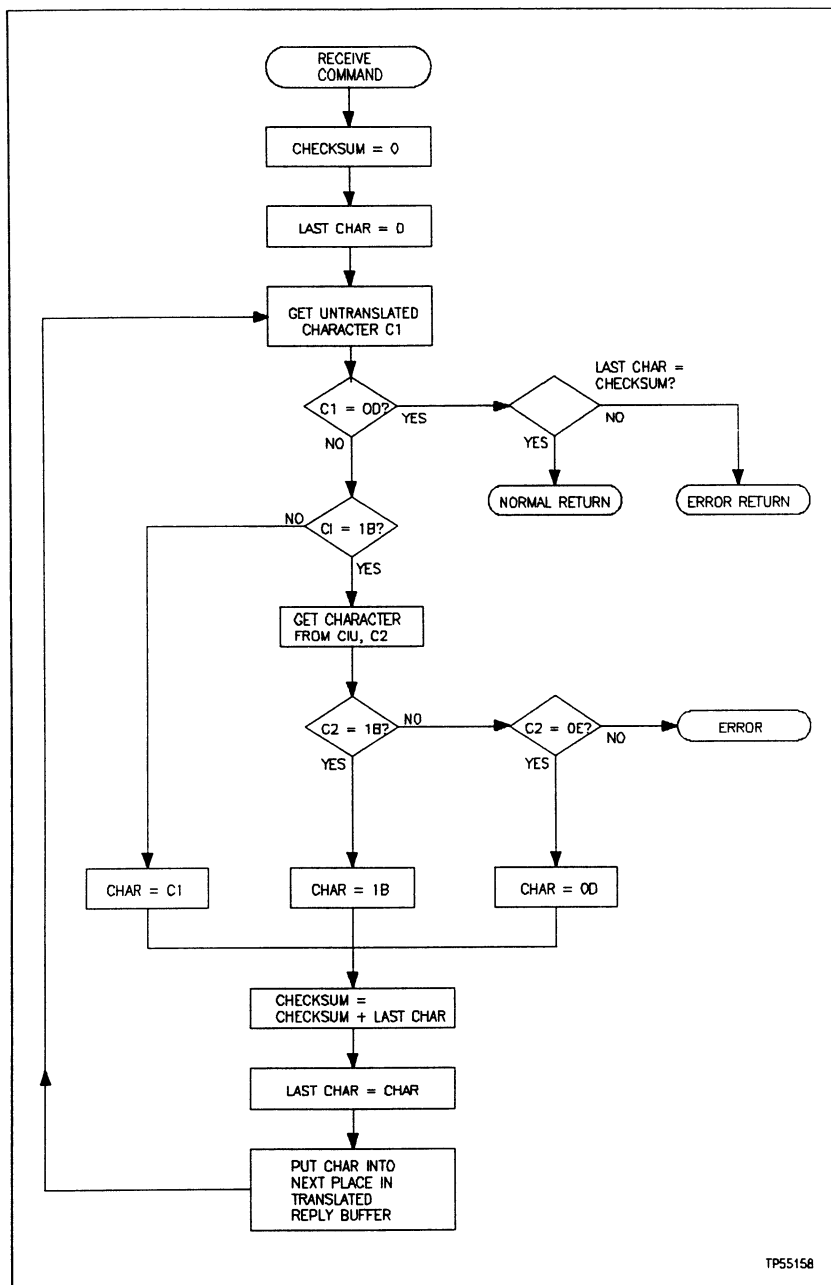


Figure 3-2. Procedure To Receive A Reply

REPLY BUFFER

The NCIU04 may return up to 1506 characters in its reply. The host should provide a reply buffer large enough to receive the largest reply expected.

COMMAND TERMINATION

Commands and replies are terminated by the unique termination character, 0D (HEX). To avoid 0D as a character

within a message, the host must perform the following translation when issuing a command:

Command/Reply Character (HEX)	Transmitted/Received Character Pair (HEX)
0D	1B 0E
1B	1B 1B

When the host receives a reply, it must test each character received for 1B, so it can translate 1B 0E to 0D, and 1B 1B to 1B. Note that 1B is only received in these two combinations.

If the host receives the entire reply before translating each character, the host must increase the size of the reply buffer to allow for character translation.

COMMAND AND REPLY CHECKSUM

A command and reply checksum is switch selectable (switch settings are described in Table A-19). When selected, the checksum byte is sent as the last byte before the terminating carriage return (0D HEX). The checksum value is the byte sum of all bytes in the message, excluding the checksum byte and the terminator. The checksum calculation is done before any 1B 1B or 1B 0E translations. The command or reply character is added into the checksum and not the transmitted or received character pair. Should the checksum equal 1B or 0D, it must be transmitted in the respective translated sequence 1B 1B or 1B 0E.

SENDING THE CHECKSUM BYTE

The host must send the checksum byte in the command string. The CIU calculates the checksum and compares it to the one sent by the computer. If a mismatch is found, the CIU replies with a NAK31 (a checksum compare error). Likewise, the CIU sends a checksum with a reply for the host to compare. If the checksum calculated by the host does not match that sent by the CIU, the host can request the reply be sent again using the *REREAD REPLY* command.

ERROR INDICATION

The CIU indicates errors by the reply code (refer to Section 9 - Reply Codes), in the first character of the reply. The host need not indicate errors to the CIU, but can retry any command or *REREAD* any reply.

The CIU will recognize a pause greater than 0.5 seconds, after any byte of a command, as a command termination. In this event, the CIU attempts to reply with a NAK27 (a Time-Out Between Bytes Error).

X-ON/X-OFF PROTOCOL

In addition to supporting the standard RS-232C handshaking lines: Clear to Send (CTS), Request to Send (RTS), and Data Terminal Ready (DTR), the CIU also handles X-On/X-Off protocol. Automatically selected in the NCIU04, a NCIU02/03 can choose this option when it issues the *CIU RESTART* command. With X-On/X-Off, the host can cause the CIU to suspend sending a reply. Thus, the host can ask for time to handle the portion of the reply received. When the host wants the CIU to suspend sending a reply (which is in progress), the host sends an X-Off (13 HEX). The CIU may send up to two characters after receiving the X-Off. When the host wants the CIU to resume the reply, the host sends an X-On (11 HEX).

The host can request the CIU to delay before replying to commands, (refer to Section 2 - *CIU RESTART*).

WORK FLAG INTERRUPTS

If the parallel port is used for communications, the host can use the CIU capability to generate single byte interrupts. The single byte interrupt sends a work flag summary flag for the *READ WORK FLAG* command. In NCIU02/03, this byte is the work flag (which is only a single byte). However, in the NCIU04, which has two work flag bytes, this is an indication that at least one work flag is set. If the byte is nonzero, a work flag has been set, and the host should issue a *READ WORK FLAG* command to obtain the value of the work flag. If the byte is zero, there are no work flags set and no work to be performed. The interrupt interval is specified by the *CIU RESTART* command. If the reply is nonzero, the CIU parallel port generates a service request to the host. When the host does a serial poll as a result of the service request, the single byte returns as the service request status. Interrupts occur at a rate no greater than specified by the *CIU RESTART* command if nonzero, and the work flag is also nonzero.

PORT ADDRESSING MODE

A switch selectable port addressing mode is supported when SW6 is enabled (Table A-19). When enabled, a port address byte must precede the command code of each command. The port address is set by switches, (refer to Table A-21). The port address mode, when enabled, applies only to serial ports.

NOTE: N/A for CIU04.

FIELDS

Command Code

The command code field is a single character containing a value listed in Table A-12.

Byte

A byte field is one character long with a value range of 0 to 255. The meanings of the byte fields are diverse and described in the command details and tables.

Integer

An integer field is two characters long with a value range of 0 to 65,535. The first character transmitted is the most significant byte; the second character the least significant.

Long

A long field is four characters long with a value range of 0 to 4,294,967,295. This first character transmitted is the most significant byte with the following bytes the least significant.

Analog (REAL(3) Format)

An analog field is three characters long with a value range from 2.7E-20 to +9.2E18. Analog fields are associated with NETWORK 90 REAL 3 floating point representation. An analog field format follows:

Character	1	Exponent	$\pm$
	2	Fraction	(MSB)
	3	Fraction	(LSB)

- The exponent is a two's complement value in the first seven bits of the first character.
- The $\pm$ is the sign of the fraction, not the exponent.
- The value is negative if the sign bit is set.

The most significant bit of the fraction is the 0.5 place; the binary point just to the left of the fraction. The fraction is always normalized. In the following examples, hexadecimal values are used.

7F	80	00	=	-4.6E18
01	C0	00	=	-0.75
01	80	00	=	-0.5
81	80	00	=	-2.7E-20
00	00	00	=	0.0
80	80	00	=	2.7E-20
00	80	00	=	0.5
00	C0	00	=	0.75
7E	80	00	=	4.6E18

REAL(2) Format

Analogous to NETWORK 90 REAL(3) floating point numbers, is the REAL(2) format. It can be returned as part of the reply to configuration type commands (**Read** and **Write Block Commands** in Sections 2 and 6). The range of REAL(2) numbers is $\pm 1.0\text{E-}3$ to $4.0\text{E}6$. Figure 3-3 shows the REAL(2) number format:

The exponent, a 5-bit two's complement value, represents the actual exponent minus seven. The $\pm$ is the sign of the fraction (not the exponent). The value is negative if the sign bit is set. The most significant bit of the 10 bit fraction is the 0.5 place; the binary point is just to the left of the fraction. The fraction is always normalized. In the following examples, HEX values are used:

7F	D1	=	-4.0E6
CF	00	=	-.75
86	0C	=	-1.0E-3
C8	00	=	0.0
82	0C	=	1.0E-3
CB	00	=	.75
7B	D1	=	4.0E6

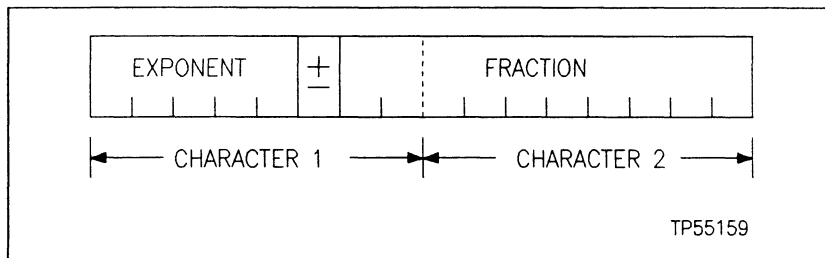


Figure 3-3. REAL(2) Format

REAL(4) Format (IEEE Standard)

Figure 3-4 illustrates IEEE Standard 32-bit Single Format.

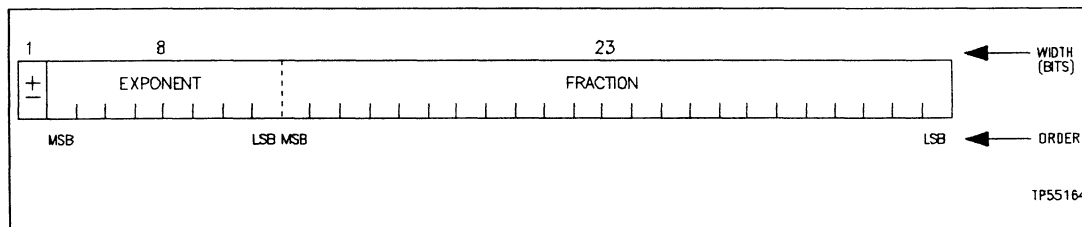


Figure 3-4. REAL(4) Format

FIXED OR VARIABLE LENGTH REPLIES

Data Items Returned

The number of data items returned by some commands depends upon process activity and cannot be predicted by the host. These commands are:

- *READ COMMAND EXCEPTIONS*
- *READ EXCEPTIONS*
- *READ MISCELLANEOUS STATUS EXCEPTIONS*
- *READ SPECS*
- *READ STATION EXCEPTIONS*
- *READ STATION SPECS*

Each of these commands has a **No. returned** field in its reply. The command descriptions reference it as V2. V2 is the number of actual data items returned in the reply. Each of these commands also has a **No. to return** field in the command. The command descriptions reference it as V1. The host can request the reply to be only as long as required by the V2 items, by issuing the command with V1=0.

As an option, the host can make the reply length predictable by issuing the command with V1 > 0. If V2 < V1, then the reply is filled out with zero fields which comply with the normal formatting rules.

KEY FIELD

When the host sets the **Key Field** of a command to zero, it requests the CIU to reply only after it has the requested data. It sets the key to a nonzero value (1..32), requesting the CIU to acknowledge immediately, and to be ready to reply after data arrives. Typical CIU commands do not wait for loop communications, so their replies are not delayed. The key field must be zero in these commands.

Some commands require the CIU to send a message over the loop and receive a response before data can be provided in the command's reply. If the host issues one of these commands and provides a zero in the key field, it receives the reply only after loop communication is complete.

As an option, the host can provide a (1..32) in the key field to which the CIU immediately replies with an ACK1, **waiting for loop** reply code. No fields follow the reply code. The CIU is now available for other commands as long as these commands have either a zero in the key field or some currently unused key. The host tests for, or obtains, the reply to the command by issuing *DEQUEUE*. The key field is set to the key used in the original command. When the reply returns, the key becomes available for use.

TOPIC DETAILS

Issuing multiple keyed commands to a particular module may cause it to become too busy to handle all issued commands. If this happens, the module replies with Error Code 101 (**Module Busy - cannot respond at this time**). This can be avoided by allowing only one outstanding command per module at a time.

INTRODUCTION

The CIU allows the host to input values, set station mode and variables, and report values as if they came from blocks configured in the host. This section explains the use of these process monitoring and control capabilities. The host can also use the CIU to read station variables and function blocks outputs.

NETWORK 90 CONTROL STRATEGY

Check the NETWORK 90 control strategy design for available inputs. Verify that input points are all configured as either station variables (FC 21, 22, 23, and 80) or function blocks which generate exception reports (FC 30, 45, 62, and 68). Also, check the parameters which define when reports are sent. These parameters are: significant change, spans, and minimum and maximum times. The following paragraphs describe CIU requirements, but other CIU, OIU, MCS, or PCUs requesting exception reports are affected by these same requirements.

MINIMUM EXCEPTION REPORT TIME

Each module has a minimum exception report time to be configured in its executive block. The Logic Master Module has several minimum exception report times each applying to a set of blocks. The Multi-Function Controller Module and Bailey PC-90TM Processor Module have minimum exception report times defined in their segment control block(s). The module only reports a block's exceptions as frequently as the minimum report time, unless the block's alarm condition changes. Each alarm condition change is reported immediately. Configure this minimum time so the host does not receive reports more frequently than required. Longer minimum times reduce the amount of data transfer during a process upset.

MAXIMUM EXCEPTION REPORT TIME

Each module has a maximum exception report time in its executive block or segment control block associated with the same set of blocks as the minimum. Even if the value has not changed significantly, the module reports the block after the maximum report time. The default maximum time is one minute and is adequate for most applications. The CIU exception report screening option can be selected by *CIU RESTART*. This avoids reporting unchanged exception

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PROCESS MONITORING AND CONTROL

report values to the host when received as a result of reaching the maximum exception report time. This option reduces much unnecessary exception reporting to the host.

SIGNIFICANT CHANGE PARAMETER

Analog values have a significant change parameter based on the configured span of the value. One significant change parameter applies to all station variables within a module (FC 21, 22, 23, and 80). This is defined in the executive block of the Controller module and in the segment control block of the Multi-Function Controller Module.

Other analog exception reports are generated by Analog Output/Loop blocks (AO/L - FC 30). AO/L has significant change of span (% of span) as one of its parameters. Configure significant change as precisely as the host requires.

COMPUTER (HOST) APPLICATION PROGRAM

When the control strategy is designed, design the host application program. The three phases of the application's operation on a point are: establishing, connecting, and reading points. One point must be established, connected, and input before going to the next point.

ESTABLISHING AN INPUT POINT

Establish an input point by issuing *ESTABLISH POINT*. This command gives the CIU the information needed to route the point's exception report to the CIU. The command also assigns the point an index in the CIU internal point table. The CIU imposes no rules on the index assignments except that they be unique and in the range 1 to 10,000 (1 to 5,000 for a NCIU02/03). When arranging these indices for an application which reads exception reports, consider that the reports carry this index as the identification the host uses to recognize the point. When arranging indices for an application which reads lists of points, consider that all points in the list must have been established as a type consistent with the read being performed. For example, *READ VALUE LIST* and *READ STATUS LIST* are not compatible with *READ MISCELLANEOUS STATUS LIST*. When reading lists, points in one scan class can be read in one command by arranging their indices consecutively.

READ TYPE GROUP COMMANDS

If it is not possible to arrange points in one scan consecutively, use the read group commands to overcome scan class indices that are not adjacent.

READ INPUT SPECS

Establishing a point causes its module to send the specifications to the CIU. The host need not read this data. Arrival of specifications cannot be predicted by the host. If specifications are desired, it is necessary to read them with *READ SPECS*, *READ STATION SPECS*, or *READ DATA SPECS* (NCIU04, only) after each point is established. Expect specifications to arrive in a sequence different from that in which they were established. Even after establishing all points, periodically read specifications to obtain any changes that may occur as a result of tuning the block. The CIU considers specification buffering to be an expendable use of the same memory allocated to establish and route points. When memory becomes over-allocated, the CIU discards all specifications which the host has not yet read. The host can eliminate, or minimize, the risk of losing specifications by checking for them at appropriate times. *READ SPECS*, *READ STATION SPECS*, and *READ DATA SPECS* (NCIU04, only) in Section 2 discusses specification attributes, when to read specifications, and how to recover lost specifications.

CONNECTING INPUT POINTS

After points are established, they must be connected, using *CONNECT POINT LIST* or *CONNECT POINT GROUP*. Connecting the points causes the modules to start sending exception reports to the CIU. If the points are not connected, the CIU receives an exception report only when the point's alarm condition changes. After the report of an alarm condition is received, the disconnected points remain disconnected.

All station points are automatically connected whenever any one of the points is connected with *CONNECT POINT LIST* or *CONNECT POINT GROUP*. The points of a station are disconnected only when all points of the station are disconnected.

READING POINTS

Four means available for reading points are: reading exceptions, reading point lists, reading point groups, and reading block outputs. These approaches are discussed in the following paragraphs.

READING EXCEPTION REPORTS

The host can input points by reading exception reports as they come from the modules. This approach has the advantage of the host receiving only reports of changing values. Read exception reports with *READ DATA EXCEPTIONS*

(NCIU04, only), *READ EXCEPTIONS*, *READ MISCELLANEOUS STATUS EXCEPTIONS*, and *READ STATION EXCEPTIONS*.

When the host reads exceptions, it receives the reports First In First Out (FIFO); the order the CIU received them from the modules. If the CIU receives a second exception report before the host reads the first, the latter value is reported. New reports are never lost. The host cannot assume the order in which the points are returned. The Time Stamp value returned in *READ DATA EXCEPTIONS* (NCIU04, only) is the only way to determine the time sequence of events.

READING LISTS OF POINTS

The host can read lists of points. The disadvantage of this approach is the host must read each point at its scan rate. The advantage of this approach is an organized data base can be read with very few commands. Read lists of points with *READ DATA LIST* (NCIU04, only), *READ MISCELLANEOUS STATUS LIST*, *READ STATION LIST*, *READ STATUS LIST*, and *READ VALUE LIST*.

READING GROUPS OF POINTS

The host can read groups of points. The disadvantage of this approach is the host must read each point at its scan rate. The advantage of this approach is a maximum group of 50 noncontiguous point indices can be put on scan, without downloading the group indices each time. Read groups of points with *READ DATA GROUP* (NCIU04, only), *READ MISCELLANEOUS STATUS GROUP*, *READ STATION GROUP*, *READ STATUS GROUP*, and *READ VALUE GROUP*.

READING BLOCK OUTPUTS

The host can read the output of any block directly by using *READ BLOCK OUTPUT*. The block does not need to generate exception reports and does not need to be established as a point in the CIU internal point table to be read. This command is not intended for normal I/O, rather for special cases where any block's output may be needed.

This command is inefficient for the host since more bytes are required in the command and reply to read each point. Since data is not stored in the CIU internal point table, the CIU must send a message to the module, and receive the module's reply before replying to the host.

STATION CONTROL

The host can use the CIU to exercise process control by setting a station's mode, set point, control output, and ratio

index. To control the process, the host also inputs process data to the CIU (refer to Table A-11).

DESIGNING CONTROL STRATEGY

Consider certain NETWORK 90 features in control strategy design, before implementing the host application. These include:

- Identify stations that the host uses to control loops.
- Determine the maximum interval within which the host commits to output to the station.
- Determine the host watchdog time-out parameter setting for the CIU and stations. Consider the maximum host output interval.

The watchdog time-out setting for the CIU is set by *CIU RESTART*. For the station it is set within the Controller Module executive block or the individual Multi-Function Controller Module station blocks.

Design the control strategy to use the station's host failure mode to handle the loss of communication with the host. Notice that the host backup mode is available as a station output to modify the control strategy automatically.

HOST APPLICATIONS

For the design of the host application, establish and connect outputs to the stations similar to process inputs. The host can now output their values repeatedly.

ESTABLISHING STATIONS IN THE CIU POINT TABLE

One or the other of these modes may be handled more efficiently by the CIU and possibly by the host. A Single Index Station Read point type uses less memory than three individually established station parameters. (refer to **Single Index Station Read**). If only one or two of the station parameters (for example set point read, control output write, or station mode) are of interest to the computer, and the NCIU02/03 is used, establish each parameter as a separate index. However, if more than two parameters are of interest to the computer, or the NCIU04 is used, establish the entire station as a single point using the Single Index Station Read block type.

SINGLE INDEX STATION READ

Establish a Single Index Station Read point with *ESTABLISH POINT*. This gives the CIU the information needed to change station variables at the host's request. As an alternative, establish a station variable write point with *ESTABLISH POINT*. This gives the CIU information needed to change that particular variable at the host's request.

Either of these actions assigns the point an index in the CIU internal point table. The entire station can be controlled through a single CIU index if the point is established as Single Index Station Read point.

INDIVIDUAL PARAMETER STATION POINTS

Alternatively, if a point is established as an individual station parameter, every other associated station parameter is referenced through a different CIU index. The CIU imposes no rules on index assignments except that they be unique and in the range 1 to 10,000 (1 to 5,000 for NCIU03, 1 to 2,500 for NCIU02).

Next, establish a variable to output to a station with *ESTABLISH POINT*. This gives the CIU the information needed to change station variables at the computer's request. The command also assigns the point an index in the CIU internal point table. The CIU imposes no rules on the index assignments except that they be unique and in the range 1 to 10,000 (1 to 5,000 for NCIU02/03).

NOTE: There are ten different station point types that can be established (refer to Table A-1). One of the ten, Single Index Station Read, combines all the attributes of the other nine. Only those station attributes of interest to the host need to be established.

ESTABLISHING STATION OUTPUTS

Although the same command is used when establishing station inputs to the computer, establishing station outputs does not create exception report routes or cause the CIU to receive specifications. In addition, station output points need not be connected.

Once station variables are established, the host can begin controlling. To supervise a control loop, the host does three things:

1. It observes the loop's operation.
2. It places the station into a host supervised mode.
3. It changes the station parameters.

STARTING LOOP SUPERVISION

When the host desires to start supervising a loop, it should determine that the loop's station is operating in some expected way. The previous section discussed host input used to observe station variables including station status.

COMPUTER SUPERVISED MODES

Placing the station in one of the Computer Supervised Modes can be done by a computer, an OIU, MCS, or DCS. Before the station allows itself to be put into a computer supervised mode, the station must indicate **Computer OK** status. This is indicated by a bit in the station status. To inform the station that it is OK, the computer outputs a **Computer OK** mode to the station using *OUTPUT STATUS* (Refer to Table 12 - **Station Mode Setting**). The computer must continue to output **Computer OK**, or some other data to the station, to prevent the module's watchdog from timing out and dropping the **Computer OK** status.

Change to a Computer Supervised Mode

Once the station has **Computer OK** status set, the station can be changed to the computer supervised mode. If *CIU RESTART* asserted the station control option, the host itself can set this mode. The host first outputs a **Go to Computer Level** status, (refer to Table A-11) to change the station to host level. Then, the host can change the station to any other supervised mode.

Changing Station Status

Even after the station has been put into a computer supervised mode, other NETWORK 90 components may change the station's mode. The host application must monitor station status to check if the host has lost control of the station. Table A-7 summarizes Station Status. The application must be designed to know when to resume supervising the station.

Changing Station Variables

Now that the station is in a computer supervised mode, the host can change station variables. Those station variables that can be set depend upon the mode in which the station is running. The host can observe progress of the output by waiting to see an exception report as a result from the output. The host can also directly check the progress by using *READ STATUS LIST*, specifying the index of the output. Once a station variable has been written it need not be rewritten unless the value changes.

ANALOG AND DIGITAL OUTPUT REPORTING

CIU Output Values

The host can use the CIU to output values other than station variables. These outputs appear as points in the CIU internal point table to the host. Other NETWORK 90 components see these outputs as if they came from Analog Exception Block (FC 30) or Digital Exception Block (FC 45). The outputs can be used by PCUs, OIUs, MCSs, and other hosts. Possible applications for CIU output are:

- A performance calculation.
- Output of a special function implemented in the host application.
- A value read by an ADAPT block (FC 24) which is dynamically tuning a gain in a PID block (FC 19), as it controls the process.

Accessing CIU Report Points¹

The NCIU03 is capable of handling up to 5000 points. Any of these points may be output points (report types). A PCU desiring to receive data from a CIU report point having an index greater than 1023, cannot access the point by its index. The CIU overcomes this limitation by using a translation from index number to module and block number. The listing that follows shows the relationship between the internal CIU index and the module and block number accessed by another PCU.

When accessing CIU indices from another node, configure the point to receive data from the module and block number as listed.

CIU Indices Accessed From Another Node	Module	Block Number
0 - 1023	2	0 - 1023
1024 - 2047	3	0 - 1023
2048 - 3071	4	0 - 1023
3072 - 4095	5	0 - 1023
4096 - 5000	6	0 - 904

1. N/A for the NCIU04

Determine the corresponding module and block number for any index using the following formulas:

Module Number = Integer Value of CIU Index/1024 + 2

Block Number = Remainder of CIU Index/1024

Example, to access CIU Index 3086:

$$3086/1024 + 2 = 3 + 2 = 5 \text{ with a remainder of } 14$$

Access this CIU index using Module 5 and block number 14.

CONTROL STRATEGY DESIGN

Design the control strategy to use these output values. Other NETWORK 90 components consider the CIU as a PCU. The system views the host as a PCU module and its output as a block number with the host assigned index for the point. The module number of the host, as seen by the rest of the NETWORK 90 system, is 2 although points may be accessed through virtual modules 3 through 6 listed in the above table.

Host Application Design

Once the control strategy is designed, the host application can be completed. After establishing an output reported point, the host can begin to output reports of the point.

Establish analog and digital report points with *ESTABLISH REPORT*. This assigns the report an index in the CIU internal point table. The establishment gives the CIU all of the information the CIU needs when sending point specifications to NETWORK 90 components requesting the point's exception reports. The CIU imposes no rules on the index assignment except that they be unique. Connecting points has no bearing on output report points.

Host Output Reporting

Once an output reported point is established, the host can begin to output reports of the point. The host outputs reports by issuing *OUTPUT REPORT* (NCIU04 only), *OUTPUT STATUS*, *OUTPUT STATUS GROUP*, *OUTPUT VALUE*, or *OUTPUT VALUE GROUP*. When the host issues an output report command, the CIU sends exception reports of the point on all routes which other NETWORK 90 components have requested. The CIU sends exception reports only when commanded by the host, or when changing CIU status causes the CIU to send reports of its own status.

The host should time outputs to conform to the NETWORK 90 exception reporting approach. The host should report a value only if it has changed significantly and a minimum reporting interval has passed. However, the host should

report a value if its reported alarm condition has changed regardless of minimum time. The host can optionally report a value after some maximum reporting interval has passed.

REMOTE CONTROL MEMORY READ

Introduction

The host can monitor and control RCM Blocks (FC 62) configured in PCUs. The RCM allows the host to switch on and off pumps, motors, or portions of control logic. (Refer to Function Code Application Manual, E93-900-20).

Reading the Input Point

The host can read the point to determine the Remote Switch Status (refer to Table A-15). To read this information, the host treats the point as an input point type **RCM Read** (refer to Table A-1). The host establishes the point with *ESTABLISH POINT* and connects it with *CONNECT POINT LIST* or *CONNECT POINT GROUP*. To read point exception reports, the host uses *READ MISCELLANEOUS STATUS EXCEPTIONS*. To poll the point values, the host uses *READ MISCELLANEOUS STATUS LIST* or *READ MISCELLANEOUS STATUS GROUP*.

Setting and Resetting the RCM

The host sets and resets the RCM by using the same point index number established to read the point. The point is established once for both reading, setting, and resetting. Connecting and disconnecting has no effect on setting and resetting the point. It only enables and disables exception reporting of the point status.

The module in which the remote control memory is configured does not impose watchdog timing on the CIU. The host does not need to set or reset the point with any regularity.

The host sets or resets the RCM with *OUTPUT STATUS*, *OUTPUT STATUS GROUP*, or *OUTPUT REPORT* (NCIU04 only). The host can either sustain, pulse the set or reset. Sustain causes the module to continue to act upon the set or reset command until it receives another set or reset. Another set or reset can come from the same CIU, a different CIU, OIU, or MCS.

Using *READ DATA EXCEPTIONS* (NCIU04 only) or *READ MISCELLANEOUS STATUS EXCEPTIONS*, the host observes the effect of the set or reset by waiting for an exception report. The host can also directly check the progress by using *READ STATUS LIST* or *READ STATUS GROUP*, specifying the point index.

REMOTE CONTROL MEMORY REPORT

Like the analog and digital output reports discussed in the preceding section, a RCM report acts as a RCM function block (FC 62) configured in the host. The point issues exception reports to OIUs, MCSs, and other hosts. Analog and Digital Output Reporting, explains the requirements for reporting data.

SWITCHING RCM REPORT POINTS

Unlike analog and digital report points, the RCM Report point type (refer to Table A-1) receives information from the NETWORK 90 system. The operator uses the OIU or MCS to switch logic on and off in the host. The host receives pulsed or sustained set and reset commands (hereafter referred to as RCM command) from the OIU or MCS.

The host uses *ESTABLISH REPORT* to establish each RCM report point. This establishes the point for both outputting and reading the RCM command.

CONNECT POINT LIST and *CONNECT POINT GROUP* have no effect on the RCM report point.

Receiving an RCM Command

The host determines whether a RCM report point has received an RCM command, from an OIU or MCS, by issuing *READ COMMAND EXCEPTIONS* if the separate commands option was selected in *CIU RESTART*. These commands reply with an RCM command if one has been received. RCM switch settings for the RCM command are listed in Table A-16. There is no minimum or maximum time associated with RCM commands.

The host must handle the point in a way which the operator views as consistent with the operation of remote control memory blocks in NETWORK 90 modules. The OIU or MCS displays the point reported by the host in the same manner as it displays one reported by a module. The significant aspects of this are discussed next.

Displaying Output and Feedback Values

When the host establishes the point, it tells the OIU or MCS whether to display the output and the feedback values. The operator expects the output value to indicate that the host has accepted the RCM command generated by the OIU or MCS. The operator is accustomed to seeing the response within one second after the set or reset button is pressed on the console. So the host must issue *READ EXCEPTIONS* frequently enough, and report the point rapidly enough, to meet this response time.

RCM Feedback Values

The operator expects the feedback value to indicate the state of the device controlled. The operator may see a delay from the time of the point set or reset until the feedback responds, due to the physical device response time.

Set Commands

The OIU or MCS displays a not-set-permissive to show the operator a set command is not accepted. The OIU or MCS does not act on this value from the host other than to display it. The OIU or MCS sends set commands to the host even if the not-set-permissive value is one. If the host honors set commands, it should always report a value of one for the set-permissive bit of the RCM status byte.

LOGIC DISPLAYS

Neither the OIU nor the MCS displays the logic set input (SI), logic reset input (RI), set command (SC), or reset command (RC) values reported by the computer. The OIU or MCS decides whether to display Override Block Logic (OVR) based upon a combination of these values and the set-permissive. The OVR indicates the RCM memory block's logic is being overridden, and a configured override signal is being used.

OVR is a function of the RCM Block in the NETWORK 90 modules. It may or may not be useful to the computer. OVR is displayed if the following formula (expressed in FORTRAN IV logic) results in a logic 1.

$$((SI.OR.SC).AND.SP).AND.(RI.OR.RC)$$

OVERRIDING BLOCK LOGIC

Block logic is overridden if the block is being set and reset at the same time. The block can be set by local logic, SI, or by an OIU or MCS command, SC. The set must also be permitted. The block can be reset either by local logic, RI, or by an OIU or MCS command, RC.

If the host does not want to display the OVR, it can report (as one possible combination) Logic 0 for SI, SC, RI, and RC. If the host wants to display the OVR it should report Logic 1 for SI, SP, and RI.

Notice that the OIU or MCS takes action on these values only to determine what to display. The host is not required to implement the RCM Block precisely as do NETWORK 90 modules. The host should, however, handle the point so that its operation appears consistent with remote memory blocks configured into NETWORK 90 modules.

REMOTE MANUAL SET CONSTANT (RMSC) READ

The host can monitor and control Remote Manual Set Constant blocks (FC 68) configured in Process Control Units (PCU). The Remote Manual Set Constant point allows the host to monitor and control, through a single block, an analog value in a remote PCU.

USING RMSC READ POINTS

The host first establishes the point with *ESTABLISH POINT*, then connects the point using *CONNECT POINT LIST* or *CONNECT POINT GROUP*. The point may also be established and connected with *ESTABLISH AND CONNECT POINT*.

EXCEPTION REPORT SPECS

Exception report specifications are received for the point after the point is established. RMSC read point specifications are read using *READ SPECIFICATIONS*.

MONITORING RMSC EXCEPTIONS

Once established and connected, the RMSC read point allows monitoring of RMSC exceptions using *READ DATA EXCEPTION* (NCIU04 only), or *READ EXCEPTIONS*. To poll the point's status and value, the host uses *READ DATA GROUP* (NCIU04 only), *READ DATA LIST* (NCIU04 only), *READ VALUE LIST* or *READ VALUE GROUP*.

The host reads and controls the RMSC point using the index number established to read the point. Connecting and disconnecting points has no effect on setting the points value. Connection status only enables or disables receiving point exception reports.

The module in which the RMSC is configured does not impose watchdog timing constraints on the CIU as in PCU stations. The host need not set the value with any regularity.

Host Setting of RMSC Block

The host sets the value of a RMSC block using *OUTPUT REPORT* (NCIU04 only), *OUTPUT VALUE* or *OUTPUT VALUE GROUP*. The value of a RMSC block can also be set by another CIU, OIU, RMSC, or MCS.

Observing Effect of Setting Block Value

If the point is connected, the host can observe the effect of setting the value. This can be done either by waiting to see an exception report using *READ DATA EXCEPTIONS* (NCIU04 only), or *READ EXCEPTIONS*, or directly using *READ DATA*

LIST (NCIU04 only), *READ DATA GROUP* (NCIU04 only), *READ VALUE LIST*, or *READ VALUE GROUP*.

RMSC control is accomplished by transmitting commands from the CIU to the PCU in which the RMSC is configured. Check the progress of transmission of these commands using *READ STATUS LIST* or *READ STATUS GROUP*.

REMOTE MANUAL SET CONSTANT REPORT

Like analog, digital, and RCM reports, the Remote Manual Set Constant report acts as a RMSC function block (FC 68) configured in the host. The point issues exception reports to PCUs, OIUs, MCSs, and other computers. **Analog and Digital Output Reporting** explains requirements for reporting data.

Like the RCM report point, the RMSC report point receives commands from the NETWORK 90 system. The operator uses the OIU or MCS to set the point value in the host. The host receives the set value command from the OIU or MCS. Refer to **Analog and Digital Output Reporting**.

ESTABLISHING RMSC REPORT POINTS

The host uses *ESTABLISH REPORT COMMAND* to establish each RMSC report point for both outputting and reading the set value commands.

CONNECT LIST and *CONNECT GROUP* have no effect on the RMSC report point.

The host determines that a set value command has been received by issuing *READ COMMAND EXCEPTIONS*. This command replies with a set value command if one has been received. There is no minimum or maximum time associated with set value commands.

INITIAL VALUE DISPLAY

When the host establishes the point, it tells the OIU or MCS the initial value to display. The operator, at the console of an OIU or MCS, expects the output value displayed to indicate that the host has accepted the set value command generated by the OIU or MCS. The operator is accustomed to seeing the response within one second after the enter pushbutton is pressed on the console. The host must issue *READ COMMAND EXCEPTIONS* frequently enough, and report the point rapidly enough, to meet this response time.

HOST GENERATION OF RMSC REPORT POINT

The host generates an exception report for an RMSC report point by issuing *OUTPUT REPORT* (NCIU04 only), *OUTPUT VALUE*, or *OUTPUT VALUE GROUP* using the same CIU index number used to establish the report.

The RMSC exception report is transmitted to all remote points which have established and connected routes to the report point's CIU index.

The host must handle the point in a way consistent with the operation of RMSC blocks in NETWORK 90 modules. The OIU or MCS displays the point reported by the host in the same manner it displays a point reported by a module.

SINGLE INDEX STATION READ

The host can monitor and control a station configured in a remote PCU through a single index in the CIU. The Single Index station read point implements this feature.

ESTABLISHING SINGLE INDEX STATION READ POINTS

The station is established once using *ESTABLISH POINT*, then connected using *CONNECT POINT LIST* or *CONNECT POINT GROUP*. The station can also be established and connected using *ESTABLISH AND CONNECT POINT*.

Exception report specifications are received for the station read point after the point is established. Single Index Station Read point specifications are read using *READ STATION SPECIFICATIONS*.

Once established and connected, the station read point type allows monitoring station exceptions using *READ DATA EXCEPTIONS* (NCIU04 only), or *READ STATION EXCEPTIONS*. If a report has been received, this command returns a report of the station status and the values of station parameters. This information can also be obtained directly using *READ DATA GROUP* (NCIU04 only), *READ DATA LIST* (NCIU04 only), *READ STATION GROUP*, or *READ STATION LIST*.

SINGLE INDEX STATION READ POINT CONTROL

The station read point can be controlled through the same CIU index used to establish the point. The host uses *OUTPUT STATUS* or *OUTPUT STATUS GROUP* to set the station mode (refer to **Change to a Computer Supervised Mode**). The host uses *OUTPUT STATION VALUE* or *OUTPUT STATION GROUP* to set station parameter values. Note that station control is only allowed by the CIU if the station control option is selected in *CIU RESTART*.

PROCESS MONITORING AND CONTROL

Connecting and disconnecting points has no effect on the output of status or values to the station. Connection status only enables or disables receipt of exception reports from the station.

The host can observe the effect of setting the station mode or of setting station values by using *READ DATA EXCEPTIONS* (NCIU04 only), *READ DATA GROUP* (NCIU04 only), *READ DATA LIST* (NCIU04 only), *READ STATION EXCEPTIONS*, *READ STATION GROUP*, or *READ STATION LIST*.

STATION CONTROL

Station control is accomplished by transmitting commands from the CIU to the PCU in which the station is configured. The progress of the transmission of these commands can be checked using *READ MISCELLANEOUS STATUS LIST* or *READ MISCELLANEOUS STATUS GROUP*.

STATION REPORT

The station report acts like other report types as a station configured in the host. The point issues exception reports to OIUs, MCSs, and other hosts. **Analog and Digital Output Reporting**, describes requirements for reporting data.

RECEIVING NETWORK 90 STATION INFORMATION

Like RCM and RMSC report points, the station report point receives information from the NETWORK 90 system. The operator uses the OIU or MCS to set the mode or parameter values of the station configured in the host. The host receives station commands from the OIU or MCS.

ESTABLISHING STATION REPORT POINTS

The host uses *ESTABLISH REPORT* to establish each station report point. This establishes the point for both outputting reports and receiving commands.

CONNECT POINT LIST and *CONNECT POINT GROUP* have no effect on the station report point.

RECEIVING COMMANDS FOR STATION REPORT POINT

The host determines whether a station report point has received a command from an OIU or MCS by issuing *READ COMMAND EXCEPTIONS*. This command replies with any station commands received. There is no minimum or maximum time associated with station commands. Note,

however, that only the most recent command for each station parameter is saved. The host must issue *READ COMMAND EXCEPTIONS* frequently enough to capture all commands required by the particular application.

VALUE DISPLAY

The operator, at the console of an OIU or MCS, expects the value displayed to indicate that the host accepts the station command generated by the OIU or MCS. The operator is accustomed to seeing the response within one second after the ENTER pushbutton is pressed on the console. The host must issue *READ COMMAND EXCEPTIONS* frequently enough, and report the point rapidly enough, to meet this response time.

GENERATING AN EXCEPTION REPORT

The host can generate an exception report for a station report point, by issuing *OUTPUT REPORT* (NCIU04 only), or *OUTPUT STATION REPORT* through the same CIU index used to establish the point. The loop exception report generated is transmitted to all remote points which have established and connected routes to the station report point's CIU index.

USE OF STATION REPORTS

The OIU or MCS uses station reports generated by the host only for display. The host is not required to implement the station block precisely as do NETWORK 90 modules. The host should, however, handle the point so that its operation appears consistent with stations configured in NETWORK 90 modules.

CIU CONTROL OF DEVICE DRIVERS

A Device Driver is a NETWORK 90 function block that provides control with feedback for a real device. The single input Device Driver (FC 123) and the Multistate Device Driver (FC 129) are accessed through the CIU, as if they were Remote Control Memory (FC 62) function blocks configured in a remote PCU.

ESTABLISHING DEVICE DRIVER POINT

Establish the Device Driver point with *ESTABLISH POINT* specifying Point Type 15 (RCM Read). Connect the point with *CONNECT POINT LIST* or *CONNECT POINT GROUP* to enable exception reports from Device Driver function blocks.

READING DEVICE DRIVER STATUS

Exceptions generated by Device Driver function blocks are read using *READ DATA EXCEPTIONS* (NCIU04 only), or *READ MISCELLANEOUS STATUS EXCEPTIONS*. Alternatively, use *READ DATA GROUP* (NCIU04 only), *READ DATA LIST* (NCIU04 only), *READ MISCELLANEOUS STATUS GROUP*, or *READ MISCELLANEOUS STATUS LIST* to obtain the most recent status of a Device Driver function block. Interpret the status returned by these commands according to Table A-28 - Device Driver (RCM) Command (FC 123), or Table A-29 - Multistate Device Driver (RCM) Command (FC 129).

HOST CONTROL OF DEVICE DRIVER FUNCTION BLOCKS

Device Driver Function Block control through the CIU is accomplished by using *OUTPUT STATUS* or *OUTPUT STATUS GROUP*, and referencing the same CIU index used with *ESTABLISH POINT*. Connecting and disconnecting has no effect on outputting status to a Device driver function block established as an RCM Read Point Type in the CIU. It only enables and disables exception reporting of the point status.

The status byte sent in *OUTPUT STATUS* or *OUTPUT STATUS GROUP* is defined in Tables A-28 and A-29. Note that other NETWORK 90 units (CIUs, OIUs, and MCSs) can also output status to the Device Driver function block.

The host can observe the effect of the Device Driver command by waiting for an exception report using *READ DATA EXCEPTIONS* (NCIU04 only), or *READ MISCELLANEOUS STATUS EXCEPTIONS*. The host can also directly check the effect by using *READ MISCELLANEOUS STATUS LIST* or *READ MISCELLANEOUS STATUS GROUP*, specifying the point index used with *ESTABLISH POINT*.

RECEIVING SEQUENCE-OF-EVENTS DATA THROUGH THE CIU

The NETWORK 90 system has the capability to log sequential events data through the use of a Sequential Events Recorder (SER), Multi-Function Controller (MFC), and a NCIU02/03, or NCIU04. The MFC provides the communication link between the SER and the CIU through the Sequence of Events function code (SOELOG, FC 99). The output of this block is an exception report that the host may use to determine when it is necessary to request sequence-of-events data. The host requests the data by issuing *READ EXTENDED PROBLEM REPORT*.

MONITORING SER DATA AVAILABILITY

In order to monitor SER data availability, the host must establish an index where the PCU, module, and block point to the SOELOG block is configured in the MFC. The host should establish this point as an *RCM READ* (Point Type 15) and connect it with *CONNECT POINT LIST* or *CONNECT POINT GROUP*.

Exception reports from this point may be received with *READ MISCELLANEOUS STATUS*. The exception report format is given in Table A-30. The host uses the V bit to determine if SER data is available. If the bit is set, then data is available. The host then receives the SER data by issuing *READ EXTENDED PROBLEM REPORT*. The host should continue to issue *READ EXTENDED PROBLEM REPORTs* until an exception report is received where the V bit is 0, indicating that no more data is available. The host then waits for another exception report before issuing more *READ EXTENDED PROBLEM REPORTs*. *READ EXTENDED PROBLEM REPORT* is described in Section 2.

INTRODUCTION

NETWORK 90 modules can exist, at any given time, in one of following three modes:

- Execute mode - the module is executing its block configuration.
- Configure mode - the module is ready to accept a new block configuration or changes to existing blocks.
- Error mode - the module has detected a block configuration error upon an attempted transition to execute mode. Error mode also can indicate the detection of some type of fatal error or event.

NOTE: Module configuration is not available in error mode. The current mode of a module, and information about it, can be determined from its five status bytes and module problem reports.

MODULE STATUS EXCEPTION REPORTS

NETWORK 90 modules issue module status exception reports to indicate their status has changed. A module status exception report is a summary; module problem report provides detailed module status.

Receiving Module Status Exception Reports

The host must use *ESTABLISH POINT* to establish a point in the CIU internal point table, for each module status desired. Module status exception reports are always connected. The computer does not need to connect them. The CIU status is automatically established as index 0 in the CIU internal point table.

Reading Module Status Exceptions And Extended Module Status

The host can input module status either by exception, list reading, or group reading. Exception reading has the advantage that data only comes when a module's status changes. Reading lists and groups requires the host to periodically read all module status to see if any have changed. Read module status exceptions by issuing *READ MISCELLANEOUS STATUS EXCEPTIONS* or *READ DATA EXCEPTIONS*. Read module status lists by issuing *READ MISCELLANEOUS STATUS LIST* or *READ DATA LIST*. Read module status groups by issuing *READ MISCELLANEOUS STATUS GROUP* or *READ DATA GROUP*.

Requesting Module Status

Module status is also available by issuing *DEMAND MODULE STATUS*. This command does not require that module status be established as a point in the CIU internal point table (refer to Table A-8).

DEMAND MODULE STATUS has disadvantages that exception reading does not. The host loses the advantage of having status changes reported immediately. The host must wait for the reply to return from the loop.

NOTE: The CIU reports each module status as five byte fields. These five bytes are described in Table A-8. The CIU reports Extended Module Status in 16 bytes.

Read Problem Report And Read Extended Problem Report

If the host wants more problem details than are summarized in the status report, the host can read the module's problem and extended problem reports. It is appropriate to read module problem reports when the host receives the module status exception with the error summary bit set (most significant bit of the first status byte).

Sequence Of Events

Extended problem reports are also used to read sequence of events data from a Multi-Function Controller Module. Extended problem reports of this nature are not tied into the module status error summary bit. The host must periodically check for extended problem reports from a Multi-Function Controller recording sequence of events data.

Although the host must establish module status as a point in the CIU internal point table, the host does not establish problem reports as points. Rather, the host demand reads problem and extended problem reports from specified modules.

The content of the Module Problem and Extended Problem Reports is described in Table A-10. The length of the PCU communication problem report is determined by the length of the reply from *READ PROBLEM REPORT*. The lengths of other types of problem reports are shown in Table A-10.

Report Number Field

The Report Number field in *READ PROBLEM REPORT* and *READ EXTENDED PROBLEM REPORT* allows the host to page through problem reports when there are too many reports for one reply. The host issues the first *READ PROBLEM REPORT* and *READ EXTENDED PROBLEM REPORT* with Report Number equal to zero. When there are more reports to read, the CIU returns a nonzero Report Number. The host must issue another *READ PROBLEM REPORT* or *READ EXTENDED PROBLEM REPORT* using this Report

Number. When there are no more reports to read, the CIU either returns only the Reply Code field (first byte) of the reply, or the entire reply with a zero in the Report Number field.

READ EXTENDED PROBLEM REPORT is also used to return sequence of events data from a Multi-Function Controller Module. The **Extended Code** field must always be set to 80FE (HEX). The Report Number field in *READ EXTENDED PROBLEM REPORT* allows the host to page through sequence of events data when there are too many for one reply. The computer issues the first *READ EXTENDED PROBLEM REPORT* with Report Number equal to zero. When there are more reports to read, the CIU returns a non-zero Report Number. The host must issue another *READ EXTENDED PROBLEM REPORT* with this Report Number. When there are no more reports to read, the CIU either returns only the Reply Code field (first byte) of the reply, or the entire reply with a zero in the Report Number field.

SYSTEM STATUS MONITORING

INTRODUCTION

The CIU can be used to configure the module function blocks described in the Function Block Specification. Configuration does not use points in the CIU point table.

CONFIGURATION COMMANDS

The CIU provides a set of commands which the host can use in a variety of approaches to NETWORK 90 configuration. Figure 6-1 details the general block data format required for configuration commands.

One approach to configuration commands is for the host to download a configuration from the computer's bulk storage to a NETWORK 90 module. This description does not consider how the host originally received the configuration.

1. The host first must use *MODULE OPERATION* to put the module into configure mode. The computer must wait for the CIU to communicate with the module and reply to the host. This is necessary since the host is downloading the module with a completely new configuration.
2. The host next issues *MODULE OPERATION* to initialize module configuration. This clears the module's nonvolatile configuration memory. The module now contains its default configuration.
3. The host issues *WRITE BLOCK* to configure the module with each function block. The host must provide the block function code and block parameter value data outlined in Figure 6-1.
4. The host verifies the configuration by reading it back from the module and comparing it with that originally sent. The host can read specific blocks by using *READ BLOCK*.
5. The format of the block data returned is outlined in Figure 6-1.
6. Using *READ NEXT BLOCK*, the host can page through the module's complete configuration. The host specifies block 0 in the first command of the sequence. The reply contains the lowest numbered block which the module has configured and the block data for it (see Figure 6-1).
7. The host then uses the returned block number in the next command in the sequence. The host pages through the blocks in this manner until the module indicates the complete configuration has been read by returning a block 0 in the reply.

PCU CONFIGURATION

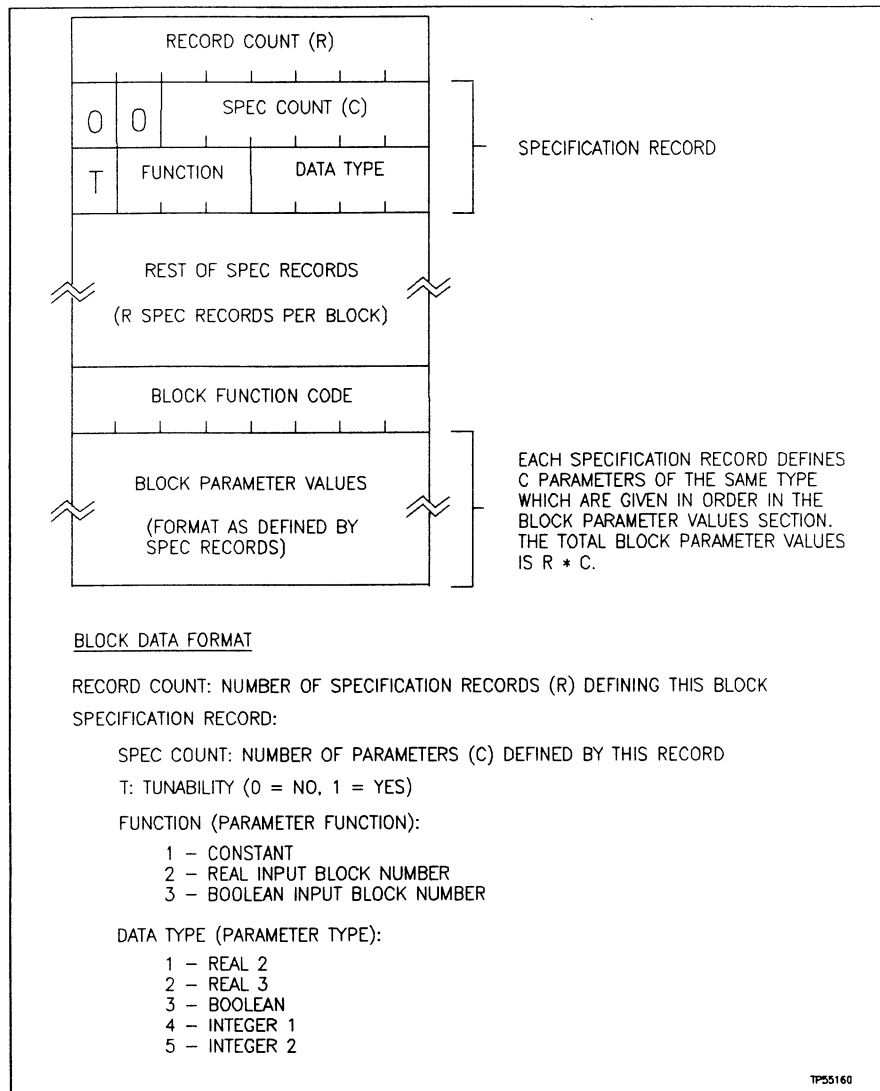


Figure 6-1. Block Data Format

Execute Mode

Once the module's configuration is verified, the host can issue *MODULE OPERATION* to put the module into execute mode. If any configuration errors are detected, the module goes into error mode and errors appear in the module status. Section 5 discusses system monitoring.

Additional Commands And Approaches

The preceding approach requires programming the host to have a data base detailing parameter data for every function code. Using *READ DEFAULT BLOCK*, the host can obtain the default parameter data for any function code the module supports. The host could be programmed to construct the module configuration, without being programmed with any information about the function codes, except optional parameter text descriptors. Such a program would be

an interactive configurator. Without the optional parameter text descriptors, the user could obtain the meanings of the parameters from the Function Block Specification.

Configuring Each Block

For each block to be configured, the host asks the user for block number and function code. The host uses this data in *READ DEFAULT BLOCK*. If the reply code is not an error code, the reply contains the default block data. The host can display these specifications to the user and allow the user to change their values. After the user has changed the values, the host can write the block using *WRITE BLOCK*. The host can also store the configured block in its own storage, so it can later download the module's configuration. The host should verify the configuration.

Changing Existing Configuration

The host can change the configuration which already exists in a module. The host must use *MODULE OPERATION* to put the module into configure mode. The host must not initialize the module's configuration. The host can issue *READ BLOCK* or *READ NEXT BLOCK* to read the module's current configuration. The host can use *WRITE BLOCK* to add a new block. To modify the specifications of an existing block, the host issues *WRITE BLOCK* with the block data containing the new values.

NOTE: When modifying existing blocks, the block number and function code must match those in the module's configuration.

The host issues *DELETE BLOCK* to remove an existing block. The host should verify the updated configuration.

Configuration Tuning Capability

The host can issue *READ BLOCK* while the module is in execute mode. The host then changes the tuneable parameters within the reply. The host sends the Block Function Code and Block Parameter Values back to the module with *TUNE BLOCK*. The host leaves the module in the execute mode when tuning.

The preceding approach to tuning is suggested for host application programs for a plant engineer who determines the new parameter gains. The approach described in **Analog and Digital Output Reporting**, in Section 4, is suggested for host programs which adaptively control by computing new gains and automatically retuning the system.

PCU CONFIGURATION

MODEM PASSWORD PROTECTION

The CIU provides modem password protection for applications where remote communication access is required. Modem password protection is switch selectable (refer to Table A-19).

NOTE: N/A for CIU04.

Enabling Modem Password

When modem password is enabled, all commands are locked out until the host issues *CIU CALLUP* containing the correct password. After a successful *CIU CALLUP*, the communication channel is opened to all commands.

Password protection applies to each communication channel. *CIU CALLUP* must be issued to each port the host uses to open access to all commands for that communication channel.

Password Description

The password is made up of eight user-defined bytes that are saved in the CIU nonvolatile memory. Password definition is an option within the CIU utilities.

When the host has completed its CIU access, it should issue *CIU HANGUP* to lock out the communication channel to other unauthorized callers.

MONITOR ONLY MODE

Disabling Control Commands

The CIU provides a means of disabling all control commands while allowing non-control commands to operate normally. This feature, Monitor Mode, is enabled and disabled through the diagnostic port facility.

Establishing Point Types

Monitor Only Mode, when enabled, does not allow establishment of certain point types, nor the selection of certain restart options. When operating in the Monitor Only Mode, the following operations are ignored:

- Establishment of certain point types
- Selecting the disallowed restart options
- Performing control functions

The complete list of commands affected by Monitor Only Mode is listed in Table A-22. The CIU replies to these commands with Reply Code 37 - Monitor Only Mode Conflict.

INTRODUCTION

The CIU has two serial ports. Port 0 is always used for host communications. Port 1 is switch selectable between a second host communication channel or an utility port (Table A-21 - SW4). When selected as a utility port and connected to a terminal, the CIU displays a menu of available options.

TALK90 OPTION

The TALK90 option is a human interface to each command supported by the CIU. When selected, the TALK90 menu is displayed. The TALK90 menu displays the names of all commands with the command number.

Selecting A Command

The user is prompted to enter a command number. Upon selecting a command, TALK90 prompts the user for each field within the command. The command is then executed by the CIU and TALK90 displays the reply. This prompts the user to enter the return key to continue.

Command Execution

Each command executed by TALK90 has the same effect as if sent by the host. TALK90 command execution can occur simultaneously with host activity on other communication channels.

UTILITY MENU

The utility menu has an option to view/configure the modem password (refer to Section 7 - Security). When this option is selected, the current password, if defined, is displayed. The user is then asked if a new password should be defined. If yes, the user is prompted to enter each password byte in HEX format.

Command And Reply Sequences

Another option of the utility menu is the capability to enable or disable displaying command and reply sequences between the host and CIU. This option is intended for debug purposes in monitoring communications between the host and CIU. This option decreases CIU throughput and should only be enabled for debug purposes.

Command/reply sequences are alternately enabled/disabled each time the option is selected. A message displays each time the option is selected, stating whether the option is enabled or disabled.

UTILITIES

Command sequences are displayed with a CS (Command from Serial port) or CP (command from parallel port) preceding each command string. The command is displayed as a series of HEX bytes. Parity, framing, and overrun errors are indicated by a *C appearing in the command sequence. Reply sequences are displayed with an RS (Reply to Serial port) or RP (Reply to Parallel port) preceding each reply string. The reply is displayed as a series of HEX bytes.

Read/set Time/date

The last option of the utility menu is the capability to read/set the CIU local time/date. When selected, the time/date is displayed. If the time/date is not synchronized with the NETWORK 90 system, the user is asked if a new time/data should be entered. If answered in the affirmative, the user is prompted for a new time/date. This method of setting the time and date is local only; it does not synch other nodes to the time and date entered. To synch the NETWORK 90 system, see *SET SYSTEM DATE AND TIME*.

INTRODUCTION

The first byte of every reply from the CIU is the reply code. The reply code informs the host of the command status just issued. Table 9-1 provides a list of all reply codes. Reply codes are separated into two types, those greater than 100, and those less than 100.

REPLY CODES GREATER THAN 100

Reply codes greater than 100 (Table A-2) are generated by the remote module intended to respond to the command from the host. In this case, the CIU is merely passing the reply code through to the host. The conflict exists between the command issued by the host computer and the remote module.

REPLY CODES LESS THAN 100

In general, a nonzero reply code less than 100 (refer to Table 9-1) implies that the CIU detected a conflict between the incoming command and the CIU's internal operation. Not every nonzero reply code, however, denotes an error.

A detailed list of reply codes is provided in Table 9-1. The right column gives a general description of the meaning of the reply code, and suggestions for correcting the problem. This list is not meant to be complete, rather it is intended to describe most commonly encountered problems.

Table 9-1. Reply Codes

Value	Reply Code	Meaning/Possible Corrective Action
0	No Error	The command was completed successfully.
1	Waiting For Loop	The command was started successfully. The CIU is now waiting for a reply from the remote PCU used in the command (refer to Key Field in Section 3). The reply, when received, may be obtained using <i>DEQUEUE</i> with the same key field in the original command.
2	Improper Format	Command to the CIU was not properly constructed. This usually indicates that the command contains too few or too many bytes. Verify that the command corresponds to CIU format (refer to Section 2 -Commands). Also verify that the Checksum option is the same for both the CIU and the host (both host and CIU have Checksum ON or OFF).

Table 9-1. Reply Codes (Continued)

Value	Reply Code	Meaning/Possible Corrective Action
3	Illegal Command	This error denotes one of three possibilities: 1. The command code in this command is invalid. 2. The command issued is not valid for the current CIU state. An example is using CIU Callup when password protection is not enabled. 3. Using the Group Command for the first time without specifying the group of points. Verify that the command code corresponds to a code listed in Table A-12. If this condition is met, the CIU must be put into the proper state to execute the command. <i>CIU RESTART</i> options are frequently the cause of this error.
4	Index Already Established (By Computer)	The host has already established a point at this index. Only one establish command may be issued for each CIU index. Either disestablish this index before using the establish command, or change the index of the new point.
5	Block Already Established Another Point	This point has already been established by the computer using another index. The PCU, module, block, and point type must be such that each index corresponds to unique data. Use the index that is already established to access this point, or disestablish the existing CIU index before establishing the point at a new index.
6	Command Too Long	The command supplied by the host is too long for the CIU to process. Shorten the command to fit within the CIU format for that command (refer to Section 2 - Commands).
7	Bad Reply From LIS (BTM for a NCIU02/03)	The Loop Interface Slave (LIS) (Bus Transfer Module (BTM) for a NCIU02/03) was unable to decipher the message sent to it. Retry the message after verifying that it is properly constructed.
8	Export Used As Import	A command that is used to read data was issued for an index established as a data exporter. Check the description of the point type established at the specified index. Reestablish it, if necessary, as the proper point type.

Table 9-1. Reply Codes (Continued)

Value	Reply Code	Meaning/Possible Corrective Action
9	Repeat CIU Restart Command	The first <i>CIU RESTART</i> executed properly. A second <i>CIU RESTART</i> is required before continuing. This is a normal response for the CIU.
10	Undefined Index	An index which was never established was used in the command. Establish the index with the appropriate data.
11	Memory Full	The capacity of the Superloop Storage Module(SSM) (Loop Storage Module (LSM) with a NCIU02/03) has been reached. Reduce the load requirement on this SSM (LSM).
12	Host Communication Error	The CIU port used by the host detected a data transmission error, e.g., a framing error or a receiver overrun error. Check the following: compatible baud rates; number of data bits; number of stop bits; parity; and noisy transmission line between the CIU and the host.
13	LIS (BTM for a NCIU02/03 Not Responding	The LIS (or BTM) is unable to communicate with the SSM (LSM). Check that modules are completely seated in the Module Mounting Unit (MMU). Check all cable connections.
14	Import Used As Export	The host attempted to output data to an index that was established for reading data. Re-establish index as an export point, or use another index.
15	Time-Out Of Plant Loop Response	A reply to a command was not received within the time allotted. Check the remote module addressed. Verify that the remote module configuration is correct, and it is in execute mode.
16	Number Out Of Range	One or more of the fields in the command was not within the acceptable limits for that command. Check the limits on each field in the command and verify that each is within the proper range as specified in Section 2 - Commands.

Table 9-1. Reply Codes (Continued)

Value	Reply Code	Meaning/Possible Corrective Action
17	Illegal Key	The key field supplied in the command was not valid. Most commands require a key field of 0. Commands that do not require a key field of 0 allow keys in the range from 0 to 32 (refer to Key Field in Section 3). Correct the key field to correspond to the command requirements. This error condition also arises if this key is already in use. Issue <i>DEQUEUE</i> before trying to use the key.
18	Need A Restart Command	The CIU requires <i>CIU RESTART</i> to define its operating parameters. This command must be issued before any command, except <i>CIU CALLUP</i>, is accepted. Issue <i>CIU RESTART</i> before attempting other commands.
19	Module Status Used As Import	An index established as a module status was accessed as a regular import point. Module status points are not accessed by commands used for other import points. Use <i>READ MISCELLANEOUS STATUS (EXCEPTION, GROUP, or LIST)</i> to access module status points.
20	Message Active On Loop	The CIU is still waiting for a reply from the plant loop. Try <i>DEQUEUE</i> again. It may be necessary to delay for a short time (2 seconds at most) between issuing the command and dequeuing the reply.
21	Import Or Export Used as Module Status	An index established as an import or export was accessed with a command intended for module status. Use <i>READ MISCELLANEOUS STATUS (EXCEPTIONS, LIST, or GROUP)</i> to access import points. Data may be written to but not read from export points.
22	Exception Report Specifications Lost	The specifications received for points established in the CIU, have been discarded by the CIU. This is done when memory used to hold these specifications is needed for another, more important function, such as establishing more points. The specifications may be brought into the CIU again by <i>REGENERATE SPECS</i>.

Table 9-1. Reply Codes (Continued)

Value	Reply Code	Meaning/Possible Corrective Action
23	No Message Queued/ Dequeue Received	<i>DEQUEUE</i> was received from the host, but there were no outstanding commands from the host. To receive the reply from an issued command with a nonzero key, <i>DEQUEUE</i> should be used.
24	Reply Too Large	The reply received, in response to a CIU command, is too large to be returned to the host. Alter the command to generate a shorter reply.
25	Illegal Station Mode Command	The host unsuccessfully attempted to change the mode of a control station. The most common causes of this error are: 1. The computer is not allowed to change station modes (refer to <i>CIU RESTART</i>, Field: Options in Section 2 - Commands). 2. The mode change requested was illegal for the current state of the station. <i>CIU RESTART</i> must be issued with options set to allow the computer to change station modes. The protocol for changing modes is described in Section 4, Station Control. Table A-11 lists valid modes.
26	Illegal Module Number In Command	CIU returns this code if <i>READ PROBLEM REPORT</i> specifies any module number other than 2 (the CIU module number) in the same PCU in which the CIU resides.
27	Time-Out Between Bytes in Command	The CIU did not receive a complete, properly terminated command from the host within the allotted time-out period. Verify that the host is properly formatting the command to the CIU. Other possible causes of this error include mismatched baud rates, and noise generated by the host, modem, or transmission lines.
28	Index Already Established (By Another Computer)	Another PCU in the system has a route established to this index in the CIU. The remote node is expecting the host to export data from this index. This index must be established as an export point using <i>ESTABLISH REPORT</i>. The report point type must correspond to that which is in the remote PCU with established routes to the CIU. The configuration of the remote PCU can also be changed to remove the exception report route record in the CIU.

REPLY CODES

Table 9-1. Reply Codes (Continued)

Value	Reply Code	Meaning/Possible Corrective Action
29	Point Type Incompatible With Command	The point type used in the command is not valid for this command. This condition arises whenever a point type is used inconsistently by the host. Generally, the conflict arises when attempting to write to an import point or read from an export point. Check the command to determine if the given point type is allowed. If necessary, re-establish the index with the proper type.
30	Watchdog Time-Out	The CIU did not receive a command from the host within the allowed time. This is specified with <i>CIU RESTART</i>. If the watchdog timer is to be used, the host must issue a command within the time period specified in <i>CIU RESTART</i>. Failure to do so, and the CIU takes itself off-line. If this option is not desired, the watchdog time in <i>CIU RESTART</i> should be set to zero.
31	Checksum Compare Error	The checksum supplied in the command differed from that calculated by the CIU. Verify that both the CIU and the host agree as to whether checksums are appended to commands. If both the CIU and the host are set up to do a checksum, then a transmission error may have caused this error. The command should be reissued.
32	Destination Node Off-line	The CIU is unable to communicate with the PCU referenced in the command. Check the remote PCU to determine why it has gone off-line. The command is not able to execute properly unless the remote PCU is on-line.
33	Callup Command Required	The CIU has password protection enabled (refer to Table A-19). <i>CIU CALLUP</i> must be issued to permit execution of any other commands (refer to Section 7). If password protection is not desired, then disable it with switch SW5 (Table A-19) and physically reset the LSM/SSM. Otherwise, issue <i>CIU CALLUP</i> with the proper password. This must be done separately for each port to be used.
34	CIU Error	The LSM/SSM has detected an internal software error. The data base in the LSM/SSM may be corrupted. Restart the LSM/SSM. If the error occurs again, notify Bailey Controls Company field service.

Table 9-1. Reply Codes (Continued)

Value	Reply Code	Meaning/Possible Corrective Action
35	CIU Busy	The CIU is unable to process the incoming command because of a surge of internal activity. This may be the result of a previous command issued by the host, or the CIU may have received a flood of data from the plant loop. Reissue the command.
36	LIS Off-line (BTM for a NCIU02/03)	The LIS (or BTM) is communicating with the loop (or LSM), but has gone off-line. The LIS (or BTM) is therefore unable to transfer data to or from the loop. <i>CIU ONLINE/OFFLINE</i> may be issued to put the LIS (or BTM) back on-line. <i>CIU RESTART</i> may also be used to put the LIS (or BTM) on-line. If the SSM (or LSM) also requires resetting, <i>CIU RESTART</i> must be used.
37	Conflict with Monitor Mode	The command supplied by the host is not in <i>MONITOR MODE</i> . Refer to Table A-22 for <i>CIU RESTART</i> options, point types, and commands that are disallowed in <i>MONITOR MODE</i> . Change command or disable <i>MONITOR MODE</i> from the diagnostic port.
38	Point Type	The point type specified in the command is not the same as the established point type. Check the point for point type. Reissue command with proper point type.
39	Destination Ring Off-Line	The CIU is unable to communicate with the ring referenced in the command. Check the Bridge Interface Unit (BIU) of the remote ring to determine why it has gone off-line. The command is not able to execute properly unless the BIU of the remote ring is on-line.
40	Destination Node Busy	Retry.
41	Destination Ring Busy	Retry.

REPLY CODES

INTRODUCTION

All modules in the NETWORK 90 System must be time synchronized for the NETWORK 90 trending features to function properly. The Time Synch function is normally performed by the MCS and the OIU, but the CIU may be selected to do time synching, if desired.

READING NETWORK 90 TIME AND DATE

READ SYSTEM TIME AND DATE may be issued at any time by the host to receive the current CIU, time and date. If the CIU has been time-synched by another OIU, MCS, or CIU, the synch field of the reply is 1. This ensures the host that the CIU time is the same as the remainder of the NETWORK 90 System. This time data may then be used to set the host's internal clock. The work flag bit is set when the time set message is received from another node.

This technique allows the host to be synchronized with the NETWORK 90 System, without the responsibility of setting the time for the entire system. If the synch field of the reply to *READ SYSTEM TIME AND DATE* is 0, then no time synching has occurred and the CIU contains a default time.

SETTING NETWORK 90 TIME AND DATE

Take the following steps if the host is to be used to provide time information through the CIU:

1. Select the Time Synch option when the CIU is restarted. This is done by adding 32 to the sum in the options field (refer to *CIU RESTART*).
2. Issue *SET SYSTEM TIME AND DATE* to provide the time information used to synch all the nodes on the plant loop.

Once time synching has begun, the CIU continues to keep the remainder of the system in synch, independent of the host. However, the host may continue to synch the system at any time by simply issuing *SET SYSTEM TIME AND DATE*. Whether the CIU is used to do time synching or not, the MCS and OIU retain the ability to do time synching.

OBTAINING TREND DATA THROUGH THE CIU

The CIU permits access to the trend blocks defined in NETWORK 98 through *TREND DATA POLL*. The sample number, used in the command, is obtained by reading the system time and date (*READ SYSTEM TIME/DATE*). Modules store trend data for up to 30 minutes. It is the responsibility of the host to issue the command at least every 30 minutes.

INTRODUCTION

A 10,000 point CIU contains an index table of 10,000 indices. The maximum number of points that the CIU can maintain in its data base is 10,000. Memory utilization also limits the number of points for which the CIU can maintain data in its internal data base. Each point established in the CIU uses up memory space. The number of bytes of memory space used by each point depends on the type of point (refer to Table A-23).

MEMORY SPACE USE

Memory space is occupied by the following:

- A PCU record created for each PCU that sends exception reports to the CIU.
- A MODULE record created for each module that sends exception reports to the CIU.
- A ROUTE record created for each PCU that requests exception reports from each report point in the CIU.
- A POINT record created for each import or export point in the CIU.

CIU MEMORY LOSS

In addition to the memory records described above, some CIU memory may be rendered unusable. This occurs in the course of normal CIU operation as a result of block fragmentation. Fragmentation can be minimized by restarting the CIU off-line, establishing the data base while off-line, and then bringing the CIU on-line. Fragmentation may also be minimized by keeping the data base static. Refraining from disestablishing a point, and then re-establishing the same point as a different type.

MEMORY USAGE CALCULATION

Memory usage for a particular CIU configuration can be calculated using Table A-23. Sample memory usage calculations for a specific data base follow.

CIU POINT CAPACITY

Number and Type of Point	NCIU04		NCIU03	
	Bytes Per Point	Total Bytes	Bytes Per Point	Total Bytes
IMPORT POINTS:				
500 Digital Read Points	34	17,000	18	9,000
500 Analog Read Points	36	18,000	22	11,000
500 RCM Read Points	44	22,000	22	11,000
10 Station Read Points (10 single index stations)	100	1,000	70	700
5 different PCUs	38	190	16	80
50 different MODULES	14	700	10	500
1,565 Total Import Points		58,890 Bytes		32,280 Bytes
EXPORT POINTS:				
200 Digital Reports	24	4,800	16	3,200
200 Analog Reports	40	8,000	30	6,000
200 RCM Reports	30	6,000	22	4,400
100 RMSC Reports	46	4,600	38	3,800
700 Remote Routes (assume one route per report)	16	11,200	6	4,200
700 Total Export Points		34,600 Bytes		21,600 Bytes
Bytes Available in CIU Memory		400,000		400,000
Bytes used in sample configuration		-93,490		-53,880
Bytes unused in sample configuration		306,510		346,120
Summary (Import + Export):		2265 Total Points		

INTRODUCTION

The Parallel Bus Slave (PBS) provides a parallel data channel between the CIU and a computer. This parallel data channel may be used instead of, or together with, the two serial channels provided with the standard CIU. The PBS is an IEEE-488 compatible General Purpose Interface Bus (GPIB) device.

PARALLEL BUS SLAVE MODULE

The PBS module receives CIU commands from the host and transfers them to the Superloop Storage Module (SSM), or Loop Storage Module (LSM) for NCIU02/03, over the expander bus. When the command reply is formulated, the PBS receives the reply from the SSM (or LSM) over the expander bus. It then makes the reply available to the host. The expander bus, an 8 bit parallel data path, is a standard feature of the NETWORK 90 Module Mounting Unit.

COMMAND AND REPLY PROTOCOL

Command and reply sequence, byte stuffing, and check summing techniques (described in Section 3 in relation to the CIU serial ports) also applies to the parallel port.

WORK FLAG SERVICE REQUESTS

The parallel port has the capability of asynchronously issuing a Work Flag Service Request to the host over the GPIB bus. The computer must then issue a Serial Poll to the PBS. The PBS replies with the work flag summary flag. This feature must be specifically enabled in *CIU RESTART* with the Interrupt Interval field set to a nonzero value.

IEEE-488 FUNCTIONS SUPPORTED

The PBS implements the Talker, Listener, and Service Request functions of the GPIB protocol. The computer must implement the Controller-in-charge function and direct all data transfers across the GPIB bus.

The PBS option consists of:

- NPBS01 Module
- NKPB01 IEEE-488 cable

Switches one and two (SW1 and SW2) must be set before installing the PBS in the MMU. See Figure 12-1 for these switch locations.

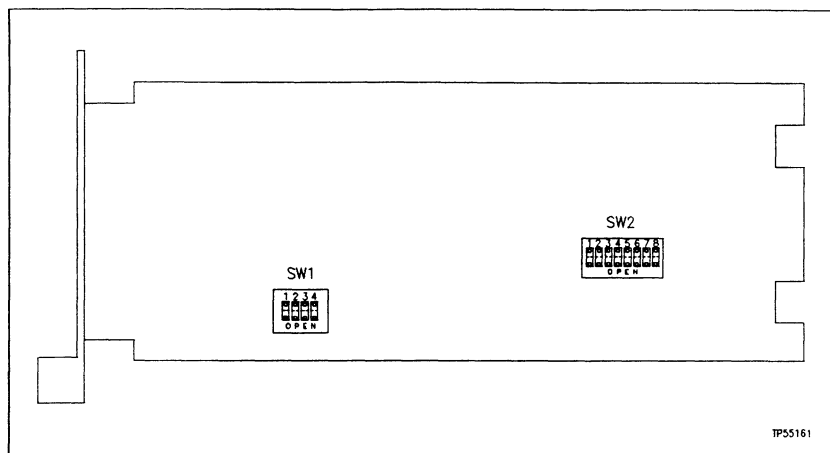


Figure 12-1. Parallel Bus Slave Module (NPBS01)

PBS SWITCH SETTINGS (SW1)

SW1 settings represent the unique device number of the PBS on the GPIB bus. The four poles of SW1 set the GPIB device number (refer to Table A-24). Pole position 1 is the most significant bit. As indicated in the device numbering table, the GPIB device number range is 0 through 15. The four bits generated by SW1 are used internally by the PBS as bits 0 through 3 of the PBS talk and listen addresses. Bit 4 of these addresses is always 0.

PBS SWITCH SETTINGS (SW2)

Setting of SW2 represents the unique Expander Bus address number of the PBS in the MMU. Pole positions 3 through 8 set the PBS expander bus address shown in Table A-25. Pole position 3 is the most significant bit. As indicated in the address table, the valid expander bus address range is 0 through 63. In Figure 12-2, Expander Bus address 21 is shown.

Pole positions 1 and 2 are not used.

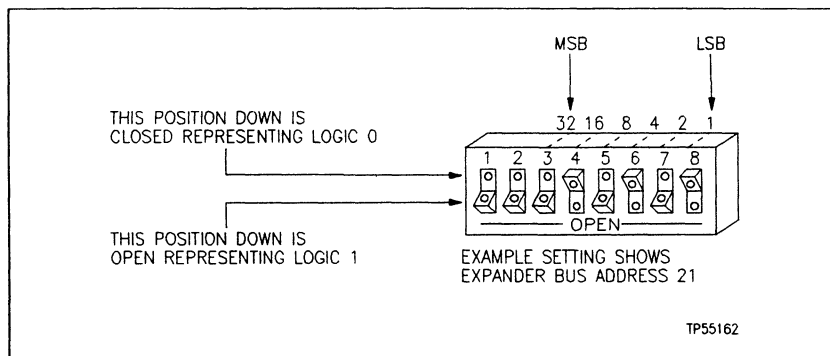


Figure 12-2. PBS Module Switch SW2

PROGRAMMING THE IEEE-488 CONTROLLER

The programmer must know the data transfer procedure for the Parallel Bus Slave (PBS) before writing a program for an IEEE-488 and a PBS. He must have the following information before configuring the data transfer.

- The GPIB bus address of the controller. This address is selected by switches on the host GPIB interface circuit board.
- The Parallel Bus Slave GPIB address. Select this address by setting SW1 on the PBS board. The controller GPIB address must differ from the address of the PBS.
- The protocol the PBS requires to exchange data. This consists of the following steps:
 1. Set the controller to CACS state to become Controller-in-charge.
 2. Instruct the controller to address the PBS to be a listener.
 3. Instruct the controller to write a command to the PBS. Terminate this command with the character 0D HEX.
 4. Instruct the controller that the host program desires notification of service requests.
 5. When a service request occurs, instruct the controller to serial poll the PBS.
 6. Instruct the controller to **unlisten** the PBS.
 7. Instruct the controller to address the PBS to be a talker.
 8. Instruct the controller to read the command reply from the PBS. The character 0D HEX terminates this reply.
 9. Instruct the controller to **untalk** the PBS.
 10. Return to step 2. Repeat steps 3 through 10 indefinitely.

STATE DIAGRAM OF PBS OPERATION

The PBS may be regarded as a state machine driven by both the LSM of the CIU, and the IEEE-488 controller of the host. The programmer must instruct the IEEE-488 controller to run the PBS in the exact sequence of steps expected by the PBS. This establishes and maintains communication between the CIU and the host.

The following state diagram should help you understand the PBS protocol. The states shown do not correspond exactly to states with similar names described in IEEE-488 documents. They are intended to show the sequence of events the PBS follows in handling commands and replies. An explanation of the state diagram follows Figure 12-3.

EXPLANATION OF STATE DIAGRAM

1. SSM (LSM for NCIU02/03) Reset or PBS module plugged into Module Mounting Unit.

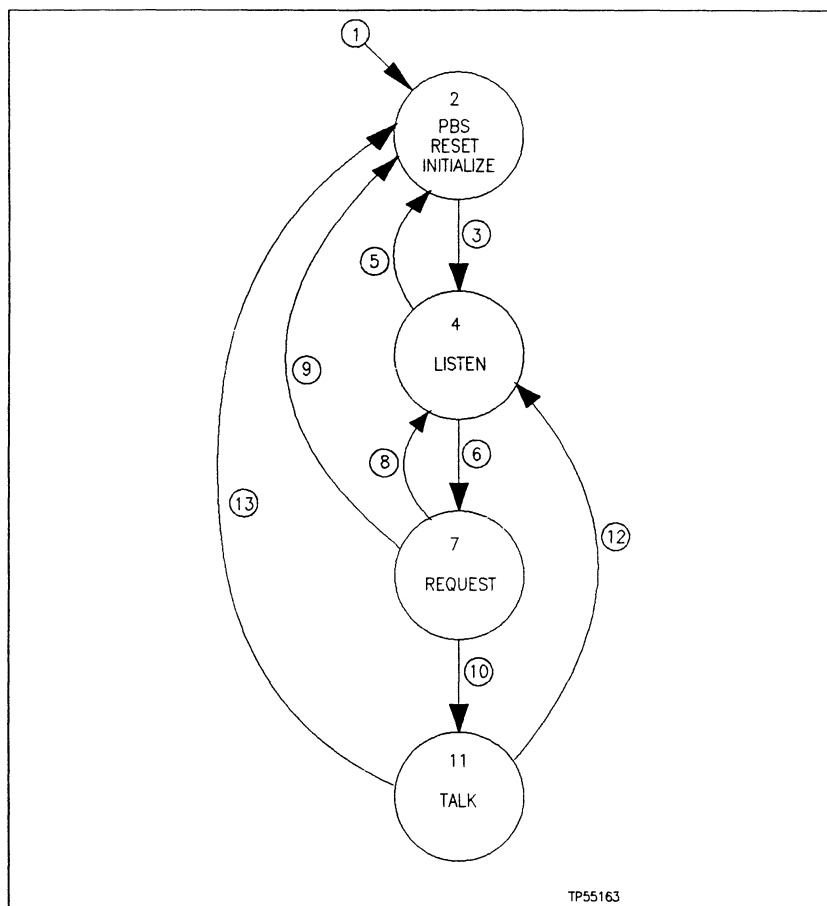


Figure 12-3. Parallel Bus Slave State Diagram

2. *PBS RESET/INITIALIZE* state:

Buffers cleared, circuitry reset. All IEEE-488 functions enter Idle state. PBS waits to be addressed as Listener.

3. PBS addressed as listener by Controller-in-charge. PBS buffers are readied to receive data.

4. *PBS LISTEN* state:

PBS receives data over the GPIB and waits for an interrupt generated by an EOM character (0D HEX). This indicates that a command has been received. When a command is received, the CIU processes the command. When the command reply is formulated, or the work flag timer expires and the work flag is nonzero, the PBS issues a service request to the host. Work flag service requests are issued only if enabled with CIU RESTART. Once begun, the host must complete the command transfer within eight seconds or a time-out may occur.

5. Time-Out occurs while receiving a command, or the SSM (or LSM) detects a communication failure between itself and the PBS.

6. PBS issues a service request either to signal that a command reply is ready or to transfer the work flag to the host.

7. *PBS SERVICE REQUEST* state:

The Controller-in-charge must serial poll the PBS to determine whether the service request was issued. This signals that a command reply is ready to be read (serial poll reply byte value is 64) or the work flag is nonzero (serial poll reply byte value is not 64). If the service request was issued to signal a reply is ready, the Controller-in-charge must address the PBS as a talker. It must read the command reply within eight seconds or a time-out occurs.

8. PBS returns immediately to *LISTEN* state and continues to wait for a command, if the service request was issued because of the work flag.

9. Time-Out occurs if the Controller-in-charge fails to address the PBS as talker and read the command reply within eight seconds. The SSM (or LSM) may also detect a communication failure between itself and the PBS.

10. Controller-in-charge addresses the PBS as talker. The PBS should only be addressed as talker if it issued a service request and replies to a serial poll issued by the Controller-in-charge.

PARALLEL BUS SLAVE OPTION

11. *PBS TALK* state:

Controller-in-charge reads data from the PBS until the EOM character (0D HEX) is detected.

12. Controller-in-charge **untalks** the PBS, then addresses the PBS as a listener. The PBS prepares itself to receive the next command.

13. Controller-in-charge fails to read reply within eight seconds, or fails to address the PBS as listener within eight seconds of reading the command reply. The SSM (or LSM) may also detect a communication failure between itself and the PBS.

Table A-1. CIU Point Types

Commands to Establish				Commands to Read Exceptions				
	Point Type	ESTABLISH POINT	ESTABLISH REPORT	READ EXCEPTIONS	READ STATION EXCEPTIONS	READ MISCELLANEOUS STATUS EXCEPTIONS	READ COMMAND EXCEPTIONS	READ DATA EXCEPTIONS ¹
Station Variables read by host	PV 1 SP 2 CO 3 Ratio 4	X		X				X
Analog Block read by host	5	X		X				X
Station Status read by host	6	X				X		X
Digital Block read by host	7	X		X				X
Station Variables written by host	SP 8 CO 9 Ratio 10	X						
Station Mode written by host	11	X						
Analog Report written by host	12		X					
Digital Report written by host	13		X					
Module Status read by host	14	X				X		X
Remote Control Memory read by host	15	X				X		X
Remote Control Memory written by host	16		X	2			3	
Single Index Station Read read by host	17	X			X			X
Station Report written by host	18		X				X	
RMSC Read read by host	19	X		X				X
RMSC Report written by host	20		X				X	
REAL (4) Analog Report Read by host ¹	21	X						X
REAL (4) Analog Report written by host ¹	22		X					
Extended Module Status read by host ¹	23	X				11		X

APPENDIX A - Reference Tables

Table A-1. CIU Point Types (Continued)

		Commands to Read List and Group					Commands to Output List and Group					
	Point Type	READ VALUE LIST	READ STATUS LIST	READ MISC. STATUS LIST	READ STATION LIST	READ DATA LIST/ GROUP ¹	OUTPUT VALUE	OUTPUT STATUS	OUTPUT MISC. STATUS	OUTPUT STATION VALUE	OUTPUT REPORT ¹	OUTPUT STATION REPORT ¹
Station Variables read by host	PV 1 SP 2 CO 3 Ratio 4	X	4			X						
Analog Block read by host	5	X	4			X						
Station Status read by host	6			X		X						
Digital Block read by host	7	X	X			X						
Station Variables written by host	SP 8 CO 9 Ratio 10		5				X					
Station Mode written by host	11		5					X				
Analog Report written by host	12						X				X	
Digital Report written by host	13		6				6	X			X	
Module Status read by host	14	6		X		X						
Remote Control Memory read by host	15		5	X		X		7				
Remote Control Memory written by host	16								X		X	
Station Index read by host	17	6		8	X	X		X		9		
Station Report written by host	18		6				6				X	X
RMSC Read read by host	19	X	5			X	10					
RMSC Report written by host	20		6				X				X	
REAL (4) Analog Block read by host ¹	21					X						
REAL (4) Analog Block written by host ¹	22					X					X	
Extended Module Status	23			11		X						

Table A-1 Notes:

1. Only available with the NCIU04.
2. Read exception commands to get Set/Reset request of RCM.
3. Optional read of Set/Reset commands selected with *CIU RESTART*.
4. Read Status commands get status, but not value.
5. Read status commands to get state of output transaction.
6. Only available with the NCIU02/03.
7. *OUTPUT STATUS* to request set/reset of RCM.
8. *READ MISC STATUS* to get status of output transactions.
9. *OUTPUT STATION VALUE* to command the value of a remote station's variable.
10. *OUTPUT VALUE* to command value of a remote RMSC point.
11. Only first five bytes of Extended Module Status are returned.

APPENDIX A - Reference Tables

Table A-2. Module Bus Reply Codes

Value	Module Bus Reply
100	Undefined message type for target module
101	Busy - cannot respond at this time
102	Mode for command does not agree with current module mode
103	Message data out of legal range
104	Invalid block number
105	Undefined block number - block number is valid but not configured
106	Block not readable - block number is valid but has no readable parameters
107	Invalid function code for target module
108	Function code and block number not compatible in target module
109	Insufficient memory to write block in EEROM and/or RAM
110	Module not responding

*Table A-3. Engineering Units
as Defaulted by OIU/MCS*

Value	Engineering Units
0	Internal Real Module Point
1	Boolean Point
2	Percent
3	Degrees, Fahrenheit
4	Degrees, Celsius
5	PSIA
6	PSIG
7	Inches of Water
8	Gallons per Minute
9	Cubic Feet per Second
10	Cubic Feet per Minute
11	Pounds per Hour
12	Gallons
13	Amperes
14	Kilopounds per Hour
15	Watts
16-31	User Defined

Table A-4. Digital Specifications

Value	Meaning
0	Logic 0 is Alarm State
1	Logic 1 is Alarm State
2	No Alarm State

Table A-5. Analog Point status

Analog Point Status = Quality + Limit Alarm + Dev. Alarm + RTG + SPT	
where:	
Quality = 128 if bad, 0 if good	
Limit Alarm = 64 if high 32 if low 0 if no alarm	
Dev. Alarm = 16 if high 8 if low 0 if no alarm	
RTG = 2 if one or more red tags, else 0	
SPT = 1 if set point tracking, else 0	
NOTES: Analog point status applies to the following Input and Output Points: Process Variable Set Point Control Output Ratio Analog Block Limit Alarm of the PV is given for all station variables. Dev. (Deviation) Alarm is the difference of SP from PV for sta- tion variables. Deviation Alarm is rate of change alarm for analog blocks.	

Table A-6. Digital Report Point Status

Digital Report Point Status = Quality + Alarm + Value
where:
Quality = 128 if bad, 0 if good
Limit Alarm = 64 if yes, 0 if no alarm
Value = 1 if on, 0 if off

Table A-7. Station Status

STATUS = BYP + MI + OT + DSF + COK + LEV + CRN + A/M
where:
BYP = 128 if bad analog output (bypassed), else 0
MI = 64 if manual interlock, else 0
OT = 32 if output tracking, else 0
DSF = 16 if Digital Station failure, else 0
COK = 8 if computer OK, else 0
LEV = 4 if computer, 0 if local
CRN = 2 if Cascade/ratio, else 0
A/M = 1 if Auto, 0 if manual

Table A-8. Module Status

Every module has five module status bytes. The first two of these bytes have a common definition, given below, for all modules. If a status item does not apply to a given module, the bit is set to 0. The last three status bytes are used to define error conditions.

Byte	7	6	5	4	3	2	1	0																								
1	ES		MODE	TYPE																												
2	FTX	MSC	RIO	LIO	CAL	AIE	EAI	STA																								
3*	A	B	C	NODE TYPE																												
4*	A	B	C	D	E																											
5*																																
BYTE 1 (all modules) = ES * 128 + MODE + TYPE																																
where:																																
ES = Error Summary 0 - no errors 1 - error(s) exist																																
MODE = Module Mode 0 - configure 1 - failed (used by BIM only) 2 - error 3 - execute																																
TYPE = Module Type																																
<table> <tr> <td>0 - reserved</td> <td>11 -NMFC01/02</td> </tr> <tr> <td>1 - NLIM01,02/ NPIM01</td> <td>12 -NLMM02</td> </tr> <tr> <td>2 - NCTM01</td> <td>13 -NMPC01</td> </tr> <tr> <td>3 - NAMM01</td> <td>14 -NLIM01,02/ NBTM01</td> </tr> <tr> <td>4 - NAOM01</td> <td>15 -NLCM01 (BJ)**</td> </tr> <tr> <td>5 - NCOM02,03,04</td> <td>16 -NLSM01,02</td> </tr> <tr> <td>6 - Unused</td> <td>17 -NGCM01 (BJ)</td> </tr> <tr> <td>7 - NLMM01</td> <td>21 -Extended</td> </tr> <tr> <td>8 - NLIM01,02/ NBIM01,02</td> <td>(Superloop)</td> </tr> <tr> <td>9 - NAMM02</td> <td>Module Type</td> </tr> <tr> <td>10 - NCIU01</td> <td>30 -NLCM02 (BJ)</td> </tr> <tr> <td></td> <td>31 -NLCM03 (BJ)</td> </tr> </table>									0 - reserved	11 -NMFC01/02	1 - NLIM01,02/ NPIM01	12 -NLMM02	2 - NCTM01	13 -NMPC01	3 - NAMM01	14 -NLIM01,02/ NBTM01	4 - NAOM01	15 -NLCM01 (BJ)**	5 - NCOM02,03,04	16 -NLSM01,02	6 - Unused	17 -NGCM01 (BJ)	7 - NLMM01	21 -Extended	8 - NLIM01,02/ NBIM01,02	(Superloop)	9 - NAMM02	Module Type	10 - NCIU01	30 -NLCM02 (BJ)		31 -NLCM03 (BJ)
0 - reserved	11 -NMFC01/02																															
1 - NLIM01,02/ NPIM01	12 -NLMM02																															
2 - NCTM01	13 -NMPC01																															
3 - NAMM01	14 -NLIM01,02/ NBTM01																															
4 - NAOM01	15 -NLCM01 (BJ)**																															
5 - NCOM02,03,04	16 -NLSM01,02																															
6 - Unused	17 -NGCM01 (BJ)																															
7 - NLMM01	21 -Extended																															
8 - NLIM01,02/ NBIM01,02	(Superloop)																															
9 - NAMM02	Module Type																															
10 - NCIU01	30 -NLCM02 (BJ)																															
	31 -NLCM03 (BJ)																															
* Except for node type, bytes 3, 4, and 5 are error conditions																																
** BJ - This nomenclature used only for Bailey Japan																																

Table A-8. Module Status (Continued)

BYTE 2 (all modules)=(FTX*128)+(MSC*64)+(RIO*32)+(LIO*16)+(CAL*8)+(AIE*4)+(EAI*2)+(STA*1)	
where:	
FTX	= First time in Execute (0 - no, 1 - yes)
MSC	= If MFC, then (0 backup OK, 1 - backup bad) else LMM (0 - memory OK, 1 - memory filled)
RIO	= Summary Remote I/O Status (0 - OK, 1 - bad) On NAMM02, indicates Remote Output Status (0 - memory OK, 1 - bad)
LIO	= Summary local I/O Status (0 - OK, 1 - bad)
CAL	= Calibration quality status for defined points (0 - OK, 1 - bad)
AIE	= Auto Initialization Input Status (0 - reset, 1 - set)
EAI	= EEROM contains default configuration (0 - no, 1 - yes)
STA	= Summary Station Status (0 - OK, 1 - bad)
BYTE 3 (CIU) = A + B + C + D	
where:	
A	= 128 if one or more PCUs are off-line, else 0
B	= 64 if Memory full, else 0
C	= 32 if Failure in node environment, else 0 (NCIU02/03 only)
D	= 16 if one or more rings are off-line, else 0 (NCIU04 only)
Node Type:	Defines the node type in which this LSM is used. Valid node types are: (0 - CIU), (1 - MCS), (2 - OIU)
BYTE 4 (CIU) = A + B + C + D + E	
where:	
A	= 128 if LIM internal problem, else 0 (NCIU02/03 only) = 128 if failure in node environment (NCIU04 only)
B	= 64 if Loop receive error channel 1, else 0
C	= 32 if Loop receive error channel 0, else 0
D	= 16 if Loop transmit error channel 1, else 0
E	= 8 if Loop transmit error channel 0, else 0
BYTE 5 (CIU) = value set by host, initially 0	

Table A-8. Module Status

Every module has five module status bytes. The first two of these bytes have a common definition, given below, for all modules. If a status item does not apply to a given module, the bit is set to 0. The last three status bytes are used to define error conditions.

Byte	7	6	5	4	3	2	1	0
1	ES		MODE	TYPE				
2	FTX	MSC	RIO	LIO	CAL	AIE	EAI	STA
3*	A	B	C	NODE TYPE				
4*	A	B	C	D	E			
5*								
BYTE 1 (all modules) = ES * 128 + MODE + TYPE								
where:								
ES = Error Summary								
0 - no errors								
1 - error(s) exist								
MODE = Module Mode								
0 - configure								
1 - failed (used by BIM only)								
2 - error								
3 - execute								
TYPE = Module Type								
0 - reserved 11 -NMFC01/02								
1 - NLIM01,02/ 12 -NLMM02								
NPIM01 13 -NMPC01								
2 - NCTM01 14 -NLIM01,02/								
3 - NAMM01 NBTM01								
4 - NAOM01 15 -NLCM01 (BJ)**								
5 - NCOM02,03,04 16 -NLSM01,02								
6 - Unused 17 -NGCM01 (BJ)								
7 - NLMM01 21 -Extended								
8 - NLIM01,02/ (Superloop)								
NBIM01,02 Module Type								
9 - NAMM02 30 -NLCM02 (BJ)								
10 - NCIU01 31 -NLCM03 (BJ)								
* Except for node type, bytes 3, 4, and 5 are error conditions								
** BJ - This nomenclature used only for Bailey Japan								

Table A-8. Module Status (Continued)

BYTE 2 (all modules)=(FTX*128)+(MSC*64)+(RIO*32)+(LIO*16)+(CAL*8)+(AIE*4)+(EAI*2)+(STA*1)	
where:	
FTX = First time in Execute (0 - no, 1 - yes)	
MSC = If MFC, then (0 backup OK, 1 - backup bad) else LMM (0 - memory OK, 1 - memory filled)	
RIO = Summary Remote I/O Status (0 - OK, 1 - bad) On NAMM02, indicates Remote Output Status (0 - memory OK, 1 - bad)	
LIO = Summary local I/O Status (0 - OK, 1 - bad)	
CAL = Calibration quality status for defined points (0 - OK, 1 - bad)	
AIE = Auto Initialization Input Status (0 - reset, 1 - set)	
EAI = EEROM contains default configuration (0 - no, 1 - yes)	
STA = Summary Station Status (0 - OK, 1 - bad)	
BYTE 3 (CIU) = A + B + C + D	
where:	
A = 128 if one or more PCUs are off-line, else 0	
B = 64 if Memory full, else 0	
C = 32 if Failure in node environment, else 0 (NCIU02/03 only)	
D = 16 if one or more rings are off-line, else 0 (NCIU04 only)	
Node Type: Defines the node type in which this LSM is used. Valid node types are: (0 - CIU), (1 - MCS), (2 - OIU)	
BYTE 4 (CIU) = A + B + C + D + E	
where:	
A = 128 if LIM internal problem, else 0 (NCIU02/03 only) = 128 if failure in node environment (NCIU04 only)	
B = 64 if Loop receive error channel 1, else 0	
C = 32 if Loop receive error channel 0, else 0	
D = 16 if Loop transmit error channel 1, else 0	
E = 8 if Loop transmit error channel 0, else 0	
BYTE 5 (CIU) = value set by host, initially 0	

Table A-8. Module Status

Every module has five module status bytes. The first two of these bytes have a common definition, given below, for all modules. If a status item does not apply to a given module, the bit is set to 0. The last three status bytes are used to define error conditions.

Byte	7	6	5	4	3	2	1	0
1	ES		MODE	TYPE				
2	FTX	MSC	RIO	LIO	CAL	AIE	EAI	STA
3*	A	B	C	NODE TYPE				
4*	A	B	C	D	E			
5*								
BYTE 1 (all modules) = ES * 128 + MODE + TYPE								
where:								
ES = Error Summary								
0 - no errors								
1 - error(s) exist								
MODE = Module Mode								
0 - configure								
1 - failed (used by BIM only)								
2 - error								
3 - execute								
TYPE = Module Type								
0 - reserved 11 -NMFC01/02								
1 - NLIM01,02/ 12 -NLMM02								
NPIM01 13 -NMPC01								
2 - NCTM01 14 -NLIM01,02/								
3 - NAMM01 NBTM01								
4 - NAOM01 15 -NLCM01 (BJ)**								
5 - NCOM02,03,04 16 -NLSM01,02								
6 - Unused 17 -NGCM01 (BJ)								
7 - NLMM01 21 -Extended								
8 - NLIM01,02/ (Superloop)								
NBIM01,02 Module Type								
9 - NAMM02 30 -NLCM02 (BJ)								
10 - NCIU01 31 -NLCM03 (BJ)								
* Except for node type, bytes 3, 4, and 5 are error conditions								
** BJ - This nomenclature used only for Bailey Japan								

Table A-8. Module Status (Continued)

BYTE 2 (all modules)=(FTX*128)+(MSC*64)+(RIO*32)+ (LIO*16)+(CAL*8)+(AIE*4)+(EAI*2)+(STA*1)
where: FTX = First time in Execute (0 - no, 1 - yes) MSC = If MFC, then (0 backup OK, 1 - backup bad) else LMM (0 - memory OK, 1 - memory filled) RIO = Summary Remote I/O Status (0 - OK, 1 - bad) On NAMM02, indicates Remote Output Status (0 - memory OK, 1 - bad) LIO = Summary local I/O Status (0 - OK, 1 - bad) CAL = Calibration quality status for defined points (0 - OK, 1 - bad) AIE = Auto Initialization Input Status (0 - reset, 1 - set) EAI = EEROM contains default configuration (0 - no, 1 - yes) STA = Summary Station Status (0 - OK, 1 - bad)
BYTE 3 (CIU) = A + B + C + D
where: A = 128 if one or more PCUs are off-line, else 0 B = 64 if Memory full, else 0 C = 32 if Failure in node environment, else 0 (NCIU02/03 only) D = 16 if one or more rings are off-line, else 0 (NCIU04 only) Node Type: Defines the node type in which this LSM is used. Valid node types are: (0 - CIU), (1 - MCS), (2 - OIU)
BYTE 4 (CIU) = A + B + C + D + E
where: A = 128 if LIM internal problem, else 0 (NCIU02/03 only) = 128 if failure in node environment (NCIU04 only) B = 64 if Loop receive error channel 1, else 0 C = 32 if Loop receive error channel 0, else 0 D = 16 if Loop transmit error channel 1, else 0 E = 8 if Loop transmit error channel 0, else 0
BYTE 5 (CIU) = value set by host, initially 0

Table A-8. Module Status (Continued)

BYTES 3, 4, and 5 for Modules Other Than CIU				
Mode	Bytes			Description
	3	4	5	
ALL	01	01	--	EEROM error: Write failure
EXE, ERR	01	02	--	EEROM error: Checksum error
ERR	01	03	--	EEROM error: Format error (Bad data)
ERR	01	FA	--	EEROM error: Reset/Power fail during SP write
ERR	01	FF	--	EEROM error: Reset/Power fail during write
ERR	02	00	04	AI reference error: 1 volt reference
ERR	02	00	05	AI reference error: 5 volt reference
ERR	03	<X>	<Y>	Missing I/O NCOM02,03,04 (X = 0), missing I/O board NAMM01, NLMM01,02 (X = Group Number), indicates slave missing NMFC01,02,03,04,05, NMPC01, NLMM02 (XY = Block No. BCD value)
ERR	05	<X>	<Y>	Configure error -undefined input X = block No. making reference Y = block No. being referenced NMFC01,02,03,04,05, NLMM02 (XY = block No. BCD value)
ERR	06	<X>	<Y>	Configure error - data type match X = block No. making reference Y = block No. being referenced NMFC01,02,03,04,05 NMPC01, NLMM02 (XY = Block No. BCD value)
ERR	07		--	Insufficient memory in remote memory X =block No. of Digital Input List
ERR	08	<X>	<Y>	Trip block activated X =block number of trip block NMFC01,02,03,04,05, NMPC01, NLMM02 (XY = Block No. BCD value)

Table A-8. Module Status (Continued)

BYTES 3, 4, and 5 for Modules Other Than CIU				
Mode	Bytes			Description
	3	4	5	
ERR	09	<X>	<Y>	Function not allowed in segment X = Segment block number Y = block number in error
ERR	10	--	--	Too many segment control blocks
ERR	11	<X>	<Y>	Segment control block priority violation X = Block number of first segment Y = Block number of violator
ALL	20	00	--	Non-verified write to calibration EEROM
ERR, CFG	21	<X>	--	Undefined slave for defined point X = Slave No.
ERR, CFG	22	<X>	--	Slave type and point type mismatch X = Point No.
ERR, CFG	23	<X>	--	Slave type and TC group definition disagree, X = Slave No.
ERR, CFG	24	<X>	--	TC point type not defined in TC group, X = Slave No.
ERR, EXE	25	00	--	Master calibration offset out of range
CFG, EXE	26	<X>	--	Cold junction RTD not connected, X = RTD ID

Table A-9. Extended Module Status

Extended Module Status has 16 bytes. The first five bytes are the same as Module Status. The TYPE is set to 21, indicating this is an Extended Module Status report. The actual module type is defined in byte 6. Bytes 7 through 15 are undefined. Byte 16 defines the firmware revision level.

BYTE 6 - Extended Module Type

32 = SSM	33 = SBM
34 = SCM	35 = BCM

Table A-10. Module and Extended Module
Problem Reports

Module Problem Reports	
Communication Problem (never mixed with other report types) P_i - off-line PCU #	1 Report Type = 1
	2 P_1
	3 P_2
	4 --
	5 --
	$n-1$ P_{n-1}
	n P_n
Local I/O (bad quality)	1 Report Type = 2
	2 Local Block Number
	3
Module Bus I/O (bad quality)	1 Report Type = 3
	2 Local Block Number
	3
	4 Remote Module Number
	5 Remote Block Number
Loop Inputs (bad quality)	6
	1 Report Type = 4
	2 Local Block Number
	3
	4 Remote Module Number
	5 Remote Block Number
Digital Control Station (commu- nication failure)	6
	7 Remote PCU Number
	1 Report Type = 5
	2 Local Block Number
Loop Output (bad quality)	3
	4 Station Address
	1 Report Type = 6
Open Thermocouple (bad quality)	2 Local Block Number
	3
	1 Report Type = 7
Cold Junction RTD (bad quality)	2 C.J. RTD Block Number
	3
	1 Report Type = 8
Unable to Calibrate (bad quality)	2 Local Block Number
	3
	1 Report Type = 9
	2 Local Block Number
	3

APPENDIX A - Reference Tables

*Table A-10. Module and Extended Module
Problem Reports (Continued)*

Module Problem Reports (Continued)	
Out of Service (bad quality)	1 Report Type = 10
	2 Local Block Number
	3
Lost Exception Report Specs (bad quality)	1 Report Type = 11
	2 Local Block Number
	3
I/O Slave (bad quality)	1 Report Type = 12
	2 Local Block Number
	3
	4 Slave Address
	5 Error type
Error Type: 1 = no response/wrong type 2 = calibration error 3 = channel failure/out of range 4 = counter overflow	

Table A-10. Module and Extended Module
Problem Reports (Continued)

Extended Module Problem Reports	
Ring Communications Byte Count = $n + 2$ Ring [i] = Offline Ring Number	1 Report Type = 17
	2 Byte Count
	3 Ring [1]
	4 Ring [2]
	5
Ring and PCU Communications Byte Count = $2 + (2*n)$ Ring [i] = Ring Number PCU [i] = Offline PCU Number	$n + 2$ Ring [n]
	1 Report Type = 18
	2 Byte Count
	3 Ring [1]
	4 PCU [1]
	5 Ring [2]
	6 PCU [2]
	7
Superloop Inputs Byte Count = 9 Local Block Number Remote Ring Number Remote PCU Number Remote Module Number Remote Block Number	$1 + (n*2)$ Ring [n]
	$2 + (n*2)$ PCU [n]
	1 Report Type = 19
	2 Byte Count
	3 Local Block
	4
	5 Remote Ring
	6 Remote PCU
	7 Remote Module
	8 Remote Block
	9

Table A-11. Station Mode Setting

Value	Meaning
0	Go to Local-Manual (Console/Station-Manual)
1	Go to Local-Auto (Console/Station-Auto)
2	Go to Local-Cascade/Ratio (Console/Station-Cascade/Ratio)
3	Go to Computer-Manual
4	Go to Computer-Auto
5	Go to Computer Cascade Ratio
6	Go to Local Level (Console/Station Level)
7	Go to Computer Level
8	Go to Computer Back-up State
9	Computer OK
10	Go to Previous State

Table A-12. Command Summary

Name	Command Code
Cancel Keyed Command	50
CIU Call Up	41
CIU Hang Up	42
CIU On-Line/Off-Line	44
CIU RESTART	19
Connect Point Group	37
Connect Point List	4
Define System Nodes	61
Delete Block	18
Demand Module Status	27
Dequeue	25
Disconnect Point Group	36
Disconnect Point List	5
Disestablish Point	23
Establish and Connect Point	49
Establish Point	1
Establish Report	2
Module Operation	12
Output Miscellaneous	3
Output Miscellaneous Group	45
Output Report	66

Table A-12. Command Summary (Continued)

Name	Command Code
Output Station Group	57
Output Station Report	59
Output Station Value	56
Output Status	11
Output Status Group	47
Output Value	10
Output Value Group	40
Read Block	13
Read Block Output	20
Read Command Exceptions	58
Read Data Exceptions	63
Read Data Group	65
Read Data List	64
Read Default Block	15
Read Exception	8
Read Extended Problem Report	46
Read Miscellaneous Status Exceptions	22
Read Miscellaneous Status Group	39
Read Miscellaneous Status List	21
Read Next Block	14
Read Problem Report	26
Read Specs	24
Read Station Exceptions	53
Read Station Group	55
Read Station List	54
Read Station Specs	52
Read Status Group	38
Read Status List	7
Read System Time/Date	43
Read Value Group	35
Read Value List	6
Read Work Flag	34
Regenerate Specs	28
Reread Reply	9
Set CIU Status	33
Set System Time/Date	60
Trend Data Poll	48
Tune Block	17
Write Block	16

Table A-13. Block Output Report Types

Value	Meaning
1	REAL (2)
2	REAL (3)
3	Boolean
4	Integer-1
5	Integer-2
6	Integer-4
7	REAL(4) - IEEE single format
8	REAL(8) - IEEE double format
9	user-defined

Table A-14. Module Operations

Value	Meaning
1	Reset
2	Configure
3	Execute
4	Initialize Module Configuration

Table A-15. Remote Switch (RCM) Status

BYTE 1 = Q + ALM + TAG + OV
BYTE 2 = SI + SP + RI + OR + FB + SC + RC
BYTE 3, 4, 5 = 0
where: Q = 128 if bad quality, else 0 (if Q = 128, other indications are undefined) ALM = 64 if alarm, 0 if normal TAG = 2 if block is tagged, else 0 OV = 1 or 0 = output value of block SI = 64 if logic set input is 1, else 0 SP = 32 if set permissive input is 1, else 0 RI = 16 if logic reset input value is 1, else 0 OR = 8 if override value is 1, else 0 FB = 4 if feedback value is 1, else 0 SC = 2 if set command is 1, else 0 RC = 1 if reset command value is 1, else 0

Table A-16. Remote Switch (RCM) Command

Value	Meaning
1	Sustain Reset
2	Sustain Set
5	Pulse Reset
6	Pulse Set

Table A-17. Remote Switch (RCM) Type Code

Switch Type = FB + NOV	
where:	
FB	= 2 if feedback signal to be displayed, else 0
NOV	= 1 if output value not displayed, else 0

Table A-18. Station Types

Value	Meaning
1	Basic with SP
2	Ratio
4	Cascade
8	Basic without SP
16	Basic with BIAS

Table A-19. Option Settings (NLSM01 U72)

Switches							
1	2	3	4	5	6	7	8
PRIMARY/SECONDARY (different between redundant LSMs)							
CHECK SUMMING (1 = ON, 0 = OFF) COMMAND/REPLY							
PORT ADDRESSING MODE (1 = ON, 0 = OFF)							
MODEM PASSWORD PROTECTION (1 = ON, 0 = OFF)							
PORT 1 OPTION (1 = UTILITY, 0 = COMPUTER)							
PORT 0 & 1 DATA CHARACTERISTICS							
0 0 - 8 data bits, 1 stop bit, no parity							
0 1 - 8 data bits, 1 stop bit, even parity							
1 0 - 8 data bits, 1 stop bit, odd parity							
1 1 - 8 data bits, 2 stop bits, no parity							
ROM CHECK SUMMING (1 = OFF, 0 = ON)							
NOTE: Switch OPEN is a logic 1 or on. Switch CLOSED is a logic 0 or off.							

APPENDIX A - Reference Tables

Table A-20. Serial Port Baud Rate Settings (NLSM01 U73)

Baud Rate	Port 0 (Terminal)				Port 1 (Printer)			
	Pole				Pole			
	1	2	3	4	5	6	7	8
50	0	0	0	0	0	0	0	0
75	1	0	0	0	1	0	0	0
110	0	1	0	0	0	1	0	0
134.5	1	1	0	0	1	1	0	0
150	0	0	1	0	0	0	1	0
300	1	0	1	0	1	0	1	0
600	0	1	1	0	0	1	1	0
1.2K	1	1	1	0	1	1	1	0
1.8K	0	0	0	1	0	0	0	1
2.0K	1	0	0	1	1	0	0	1
2.4K	0	1	0	1	0	1	0	1
3.6K	1	1	0	1	1	1	0	1
4.8K	0	0	1	1	0	0	1	1
7.2K	1	0	1	1	1	0	1	1
9.6K	0	1	1	1	0	1	1	1
19.2K	1	1	1	1	1	1	1	1

NOTE: Switch open is a logic 1 or ON.
Switch closed is a logic 0 or OFF.

Table A-21. Port Address (NLSM01 U75 when enabled)

POLE	1	2	3	4	5
Binary weight	16	8	4	2	1
Port address = sum →	X	X	X	X	X

Module Address (0-3)

Superloop Diagnostics Enable
0 = Normal SSM operation
1 = Diagnostics enabled

LIS Diagnostics Mode
0 = Normal SSM operation
1 = LIS diagnostics (SSM operation disabled)

Test Mode Enable
0 = Normal SSM Operation
1 = test mode enabled
(LIS Handshake Timeouts ignored)

Table A-22. Monitor Mode Effect on CIU Commands

Command	Effect on Command Operation														
CIU RESTART	The computer may not select the option to change the mode of a station.														
	The computer may not select the option to do Time Synching of the NETWORK 90 system.														
Establish Point	The following Point Types may not be established: <table> <tr> <th>Number</th><th>Name</th></tr> <tr> <td>8</td><td>Station Set Point written by computer</td></tr> <tr> <td>9</td><td>Station Control Output written by computer</td></tr> <tr> <td>10</td><td>Station Ratio written by computer</td></tr> <tr> <td>11</td><td>Station Mode written by computer</td></tr> <tr> <td>17</td><td>Station Read</td></tr> <tr> <td>19</td><td>RMSC Read</td></tr> </table>	Number	Name	8	Station Set Point written by computer	9	Station Control Output written by computer	10	Station Ratio written by computer	11	Station Mode written by computer	17	Station Read	19	RMSC Read
Number	Name														
8	Station Set Point written by computer														
9	Station Control Output written by computer														
10	Station Ratio written by computer														
11	Station Mode written by computer														
17	Station Read														
19	RMSC Read														
Establish Report Output Report Output Value Output Value Group Output Status Output Status Group Output Miscellaneous Output Miscellaneous Group Module Operation Set CIU Status Write Block Tune Block Delete Block Output Station Value Output Station Group Output Station Report Set System Time/Date Define System Nodes	Disabled														

APPENDIX A - Reference Tables

Table A-23. Memory Utilization By Point Type

Import Points	
Point Type	Bytes Per Point
Digital Read	34
Analog Read	36
Module Status	38
Station Status	100
Station Read (SP, PV, CO, RI)	100
RCM Read	44
Single Index Station Read	100
RMSC Read	48
REAL(4) Analog Read	38
Additional bytes required: each different PCU requires 16 bytes each different remote MODULE requires 10 bytes	
Export Points	
Point Type	Bytes Per Point
Digital Report	24
Analog Report	40
RCM Report	30
Station Mode	100
Station Report	84
RMSC Report	46
REAL(4) Analog Report	42
Additional bytes required: each ROUTE record requires 16 bytes	
Total Memory Available: 400,000 bytes	

Table A-24. PBS Device Number Dipswitch SW1

Device Number	Pole Number 1 2 3 4	Device Number	Pole Number 1 2 3 4
0	0 0 0 0	8	1 0 0 0
1	0 0 0 1	9	1 0 0 1
2	0 0 1 0	10	1 0 1 0
3	0 0 1 1	11	1 0 1 1
4	0 1 0 0	12	1 1 0 0
5	0 1 0 1	13	1 1 0 1
6	0 1 1 0	14	1 1 1 0
7	0 1 1 1	15	1 1 1 1

Table A-25. PBS Address Dipswitch SW2

PCU Address	Pole Number 1 2 3 4 5 6 7 8	PCU Address	Pole Number 1 2 3 4 5 6 7 8
1	0 0 0 0 0 0 0 1	33	0 0 1 0 0 0 0 1
2	0 0 0 0 0 0 1 0	34	0 0 1 0 0 0 1 0
3	0 0 0 0 0 0 1 1	35	0 0 1 0 0 0 1 1
4	0 0 0 0 0 1 0 0	36	0 0 1 0 0 1 0 0
5	0 0 0 0 0 1 0 1	37	0 0 1 0 0 1 0 1
6	0 0 0 0 0 1 1 0	38	0 0 1 0 0 1 1 0
7	0 0 0 0 0 1 1 1	39	0 0 1 0 0 1 1 1
8	0 0 0 0 1 0 0 0	40	0 0 1 0 1 0 0 0
9	0 0 0 0 1 0 0 1	41	0 0 1 0 1 0 0 1
10	0 0 0 0 1 0 1 0	42	0 0 1 0 1 0 1 0
11	0 0 0 0 1 0 1 1	43	0 0 1 0 1 0 1 1
12	0 0 0 0 1 1 0 0	44	0 0 1 0 1 1 0 0
13	0 0 0 0 1 1 0 1	45	0 0 1 0 1 1 0 1
14	0 0 0 0 1 1 1 0	46	0 0 1 0 1 1 1 0
15	0 0 0 0 1 1 1 1	47	0 0 1 0 1 1 1 1
16	0 0 0 1 0 0 0 0	48	0 0 1 1 0 0 0 0
17	0 0 0 1 0 0 0 1	49	0 0 1 1 0 0 0 1
18	0 0 0 1 0 0 1 0	50	0 0 1 1 0 0 1 0
19	0 0 0 1 0 0 1 1	51	0 0 1 1 0 0 1 1
20	0 0 0 1 0 1 0 0	52	0 0 1 1 0 1 0 0
21	0 0 0 1 0 1 0 1	53	0 0 1 1 0 1 0 1
22	0 0 0 1 0 1 1 0	54	0 0 1 1 0 1 1 0
23	0 0 0 1 0 1 1 1	55	0 0 1 1 0 1 1 1
24	0 0 0 1 1 0 0 0	56	0 0 1 1 1 0 0 0
25	0 0 0 1 1 0 0 1	57	0 0 1 1 1 0 0 1
26	0 0 0 1 1 0 1 0	58	0 0 1 1 1 0 1 0
27	0 0 0 1 1 0 1 1	59	0 0 1 1 1 0 1 1
28	0 0 0 1 1 1 0 0	60	0 0 1 1 1 1 0 0
29	0 0 0 1 1 1 0 1	61	0 0 1 1 1 1 0 1
30	0 0 0 1 1 1 1 0	62	0 0 1 1 1 1 1 0
31	0 0 0 1 1 1 1 1	63	0 0 1 1 1 1 1 1
32	0 0 1 0 0 0 0 0		

Table A-26. Device Driver Exception (FC 123)

BYTE 1 = Q + ALM + TAG + V	
BYTE 2 = F2 + F1 + FS + SO + MODE	
BYTE 3, 4, 5 = 0	
where:	
Q = 128 if bad quality, else 0	
(if Q = 128 other indications are undefined)	
ALM = 64 if alarm, 0 if normal	
TAG = 2 if block is tagged, else 0	
V = 1 or 0 = block output value	
F2 = 32 if input 2 feedback state is 1, else 0	
F1 = 16 if input 1 feedback state is 1, else 0	
FS = 8 if feedback status value bad is 1, else 0	
SO = 4 if override value is 1, else 0	
MODE = 2	
where:	0 0 - Auto
	0 1 - Remote
	1 0 - Manual
	1 1 - Unused

Table A-27. Multistate Device Driver Exception (FC 129)

BYTE 1 = Q + ALM + SO + CO + M + TAG + V	
BYTE 2 = F1 + F2 + F3 + F4 + GS + RS	
BYTE 3, 4, 5 = 0	
where:	
Q = 128 if bad quality, else 0	
ALM = 64 if alarm, 0 if normal	
SO = 32 if status override value is 1, else 0	
CO = 8 if control override value is 1, else 0	
M = 4 if auto mode is 1, else manual 0	
TAG = 2 if block is tagged, else 0	
V = 1 if in control output state 1, else 0	
F1 = 128 if input 1 feedback state is 1, else 0	
F2 = 64 if input 2 feedback state is 2, else 0	
F3 = 32 if input 3 feedback state is 3, else 0	
F4 = 16 if input 4 feedback state is 4, else 0	
GS = Good State table value:	
Good State	State Value
0	0
1	4
2	8
3	12
RS = Requested state table value:	
Good State	State Value
0	0
1	1
2	2
3	3

Table A-28. Device Driver (RCM) Command (FC 123)

7	6	5	4	A	M	S	R
3	2	1	0				
where:							
A: Auto	=	8	1	=	request automatic mode		
M: Manual	=	4	1	=	request manual mode		
S: Set	=	2			Set Control Output		
R: Reset	=	1			Reset Control Output		

APPENDIX A - Reference Tables

Table A-29. Multistate Device Driver (RCM) Command
(FC 129)

7	6	5	4	A	M	RS	0
				3	2	1	0
where:							
A:	Auto	=	8	1	=	request automatic mode	
M:	Manual	=	4	1	=	request manual mode	
RS:	Requested State		0 - 3			Device Driver state	

Table A-30. Sequence of Events Block Output Definition
(FC 99)

BYTE 1 = Q + ALM + V
BYTE 2 = Ovrflw + Count
where:
Q = 128 if bad quality (SER status bad or MFC to SER Communication failure), else 0
ALM = 64 if alarm, else 0
V = 1 SER is available to be read, else 0
Ovrflw = 128 if buffer overflow, else 0
Count minus lower order 7 bits = New Data Count

Table A-31. Remote Motor Control (RMC) Command
(FC 136)

A	7	6	5	4	3	2	S	R	0
							1		0
where:									
S:	Set				1	=	start		
R:	Reset				1	=	stop		
A:	Acknowledge			1	=	acknowledge fault			

Table A-32. Status/Value Formats by Point Type

Point Type	Value	Byte Number
Bad Quality Alarm Management (0)	Bad Quality Status	1
Station Process Value Read (1)		
Station Set Point Read (2)		
Station Control Output Read (3)	Status	1
Station Ratio		2
Index Read (4)	Value (REAL (3))	3
Analog Read (5)		4
Station Set Point Write (8)		
Station Control Output Write (9)		
Station Ratio		
Index Write (10)		
Analog Report (12)		
RMSC Read (19)		
RMSC Report (20)		
Station Status (6)	Status of PV	1
	Station Status Byte	2
Digital Read (7)	Q A V	1
Digital Report (13)		
Station Mode (11)	Station Mode Setting	1
Module Status (14)		1
		2
	Status	3
		4
		5
RCM Read (15)	Q A T V	1
RCM Report (16)	Si P Ri O F Sc Rc	2
Station Read (17)	Station Status	1
Station Report (18)		2
	PV Value (REAL (3))	3
		4
		5
	SP Value (REAL (3))	6
		7
		8
	CO Value (REAL (3))	9
		10
		11
	RI Value (REAL (3))	12
		13
	Station Mode Status	14

APPENDIX A - Reference Tables

Table A-32. Status Value Formats by Point Type (Continued)

Point Type	Value	Byte Number
REAL (4) Analog Read (21) REAL (4) Analog Report (22)	Status	1
		2
		3
	Value (REAL (4))	4
		5
Extended Module Status (23)	Status	1
		2
		3
		4
		5
	Extended Module Type	6
	Undefined	7
		.
		.
		15
	Firmware Revision Level	16

Table A-33. Specification Formats by Point Type

Point Type	Value	Byte Number
Station Process Value Read (1) Analog Read (5) RMSC Read (19) RMSC Report (20)	Engineering Units	1
		2
	Span (REAL (3))	3
		4
		5
	Zero (REAL (3))	6
		7
		8
	High Alarm (REAL (3))	9
		10
		11
	Low Alarm (REAL (3))	12
		13
Station Set Point Read (2)	Engineering Units	1
		2
	Zero (REAL (3))	3
		4
		5
	Span (REAL (3))	6
		7
	Deviation Alarm (REAL (3))	8
		9
		10
Digital Read (7) Digital Report (13)	Alarm Specification	1
RCM Read (15) RCM Report (16)	Switch Type	1
Station Read (17) Station Report (18)	Engineering Units	1
		2
	High Alarm (REAL (3))	3
		4
		5
	Low Alarm (REAL (3))	6
		7
		8
	Deviation Alarm (REAL (3))	9
		10
		11
	PV and SP Span (REAL (3))	12
		13
		14
	PV Zero (REAL (3))	15
		16
		17
	SP Zero (REAL (3))	18
		19
	Station Type	20

APPENDIX A - Reference Tables

*Table A-33. Specification Formats by Point Type
(Continued)*

Point Type	Value	Byte Number
RMSC Read (19)	Engineering Units	1
	Low Limit (REAL (3))	2
		3
		4
	Limit Span (REAL (3))	5
		6
		7
	High Limit (REAL (3))	8
		9
		10
	Low Limit (REAL (3))	11
		12
		13
Read (21) REAL (4) Analog REAL (4) Analog Report (22)	Engineering Units	1
	Zero (REAL (4))	2
		3
		4
		5
	Span (REAL (4))	6
		7
		8
		9
		10
	High Alarm (REAL (4))	11
		12
		13
		14
	Low Alarm (REAL (4))	15
		16
		17
		18

Table A-34. Status Value Field Definition

Bad Quality Status = R + N + M
where: R = 4 if the RING of the point has failed N = 2 if the NODE of the point has failed. M = 1 if the MODULE of the point has failed.

Table A-35. Block Output Report Formats

REAL (2) (Report Type 1)									
1	Q	H/L	DEV	C	S	0			
2	REAL (2) Value								
3									
REAL (3) (Report Type 2)									
1	Q	H/L	DEV	C	S	0			
2	REAL (3) Value								
3									
4									
Boolean (Report Type 3)									
1	Q	ALM	0	0	0	0	0	0	V
Integer-1 (Report Type 4)									
1	0	0	0	0	0	0	0	0	0
2	Integer-1 Value								
Integer-2 (Report Type 5)									
1	0	0	0	0	0	0	0	0	0
2	Integer-2 Value								
3									
REAL (4) (Report Type 6)									
1	Q	H/L	DEV	C	S	0			
2	REAL (4) Value								
3									
4									
5									
where:									
ALM:	Alarm state=				0 - OK 1 - in alarm				
C:	Calibration quality flag=				0 - normal 1 - calibration correction values out-of-range				
DEV:	Deviation alarm state=				0 - normal 1 - low deviation alarm				
H/L:	High/low alarm state=				0 - normal 1 - low alarm 2 - high alarm				
Q:	Quality=				0 - good 1 - bad				
S:	Point disabled flag= (AMM02)				0 - normal 1 - point being serviced				
V:	Boolean value								

ACK	Positive acknowledgment. The requested action has been completed. CIU reply code 0 is an ACK.
Analog	A value expressed in Real-4, Real-3, or Real-2 format as opposed to a digital value (0 or 1). Many NETWORK 90 function blocks produce analog outputs.
Block Data	Synonym for function block specifications.
Block Value	The output of a NETWORK 90 function block which may be either digital or analog.
Checksum	The bitwise sum of all bytes in a NETWORK 90 command, except for the checksum byte itself and the command terminator. This single byte quantity is the next to last byte transmitted in a CIU command. It is followed only by the command terminator. CIU commands must have checksums. Command replies have checksums if the checksum option switch U72 (SW7 of the LSM CPU board) is ON.
Command Terminator	CIU commands and replies must be terminated with an ASCII carriage return character (0D HEX).
Configuration	NETWORK 90 control strategies are implemented by configuring function blocks in NETWORK 90 modules. The user selects functions from a control function library to design a control strategy. The module being configured must be in Configure mode. Configurations may be downloaded through the CIU or through OIUs or MCSs. Modules may also be configured manually with a Configuration and Tuning Module (CTM). Once configured, a NETWORK 90 system module retains its configuration in EEROM (Electrically Erasable Read-Only Memory), or battery-backed RAM (Random Access Memory), until its configuration is rewritten or the module is initialized.

Connection	NETWORK 90 exception reports are sent only to blocks which are connected, that have activated an exception report route. Exception report routes must be established prior to connection. A route may be disconnected to prevent the originating module from sending exception reports. Alarm change exception reports are sent to blocks with established routes, regardless of their connection status.
Control Output (CO)	Analog output of a NETWORK 90 station function block. May be both read from and written to by a host through the CIU.
Control Variables	Variables subject to manipulation, regulation, or control by OIUs, MCSs, host computers, or other NETWORK 90 control elements. Station set points and RMSC Read points are examples of NETWORK 90 control variables.
Data Communication Equipment (DCE)	Equipment providing functions such as establishing and terminating a connection between two devices. This equipment also performs the necessary code conversions in transmitting and receiving data. In RS-232-C communication systems, the DCE nomenclature indicates which signals appear at specified contacts of the cable connectors. Modems are an example of devices included in this class of equipment.
Data Terminating Equipment (DTE)	Equipment comprising the data source, data sink, or both, that provides for the communication control function. In RS-232-C communication systems, the DTE nomenclature indicates which signals appear at specified contacts of the cable connectors. Printers and terminals are examples of devices included in this class of equipment.
Device Driver	A NETWORK 90 system function block that provides control for a single input device. A multistate device driver provides control for a dual input device. The RCM read CIU point type serves as the CIU interface between the host and the device driver, configured in a remote PCU.

Digital	A value that is either 1 or 0. Many NETWORK 90 system function blocks provide a digital output.
Establish	Establishment is the mechanism which enables exception reports to flow between NETWORK 90 nodes. Each node maintains records of exception report routing information. Establishing a point enables exception reports, but generally does not cause them to occur. The CIU point table consists of points which have been established by the host, or by another PCU, OIU, or MCS on the plant loop.
Exception Report	A NETWORK 90 message that is generated as a result of an alarm, or a significant change in the output value of a NETWORK 90 function block. Exception reports are also generated at maximum reporting intervals, even if no change in value has occurred.
Executive Block	A function block located at a fixed block number in a NETWORK 90 module. It includes specifications that determine execution and operating characteristics of the module.
Export Point	A point established in the CIU through which the host exports control information, or data to other nodes in the NETWORK 90 system. All report points are export points, as are station variable write points, RCM Read, RMSC Read, and Single Index Station Read points.
Fail-over	For systems with redundant CIUs, the process of transferring control and monitor functions to a secondary or redundant CIU.
Fatal Error	A condition that causes a module to take itself off-line ("red light"). Generally caused by failed components or other hardware problems.
Gateway Module	A NETWORK 90 system module that enables exception reports and control commands to pass from one plant loop to another.

General Message Interface (GMI)	A loop message type that allows communication between modules. The message is sent to the BIM (or SBM) of the PCU in which the module resides. The BIM (or SBM) then passes the message on to the module. The module generates a reply which is returned to the originating node.
HEY	A module bus message that enables the BIM to determine what module numbers in the PCU are active.
Host	Any computer, OIU, MCS, or terminal that controls or monitors a NETWORK 90 system through a CIU.
IEEE-488	The General Purpose Interface Bus (GPIB) specification. Defines the hardware and protocol of the GPIB which is an 8-bit wide parallel data interface.
Import Point	Synonymous with Read Point.
Index	An integer (16 bit) value which specifies a particular entry in the CIU point table. The point table entry in turn refers to a particular PCU, module, and block. To other NETWORK 90 system modules, the CIU index is equivalent to the block number of a point configured in the CIU.
Key Field	A single byte field of CIU commands. If this field is zero, the CIU processes the command and waits for a reply from the node referenced, before responding to the host. If this field is a valid key number other than zero, the CIU replies immediately with a code that indicates Waiting for Plant Loop Response . The plant loop response, when it becomes available, may be obtained with DEQUEUE. Only commands which generate plant loop messages and produce replies may have non-zero keys.
Mode (Station)	Station Mode defines the part of the station operating state, that determines whether the Control Output and Set Point may be adjusted from interface devices.

Module Number	A number, from 0 to 31, which refers to a particular NETWORK 90 module within a node.
NAK	A negative acknowledge indicating the particular CIU command issued was rejected by the CIU, or the operating state of a particular node or module prevented the command from completing successfully. A NAK may also indicate another command needs to be issued in order to complete the requested action.
Node	An OIU, MCS, CIU or PCU on the NETWORK 90 plant loop.
Not-Set-Permissive	A remote switch input (RCM function block) which disables remote switch set commands.
Operating State of Station	Blocks Station operating state is defined by the Level (either local or computer), Mode (either manual or automatic), and the status of the Cascade and Ratio specifications. The operating state determines which outputs may be adjusted from operator interface devices.
Override (OVR)	A remote switch input (RCM function block) that controls the block output under certain conditions.
Passbyte	A byte field of the CALLUP command that must match the corresponding byte of the password set for the CIU. Match failure of any passbyte in the CALLUP command causes that command to fail.
Plant Communication Loop (Plant Loop or Superloop)	A bit serial, two wire data loop that connects NETWORK 90 nodes forming a single communication network. The plant loop provides complete communication capability between all points on the loop.
Point Table	The CIU data base is referred to as its point table. The status and value of a NETWORK 90 point may be accessed through the CIU point table index, after the point has been established and connected.

APPENDIX B - Glossary

Point Types	Twenty types of points may be established in a NCIU02/03. Each point type has different attributes.
Primary	Synonymous with on-line. In the case of redundancy, the primary CIU would be the one communicating on the plant loop.
Problem Report	A problem report is a summary of error conditions provided by NETWORK 90 modules. The error summary bit of the module status indicates problem information is available. Problem reports may be obtained by the host with READ PROBLEM REPORT.
Process Variable (PV)	Analog input to a NETWORK 90 function block. The Process Variable may be both read and written by the host through the CIU.
Ratio Index (RI)	Analog input to a NETWORK 90 station function block. The Ratio Index variable may be both read and written by the host through the CIU.
Read Point	A point established in the CIU with ESTABLISH POINT. Read points receive exception reports from function blocks configured in other NETWORK 90 nodes.
REAL(3) Floating Point Representation	An analog value expressed as a floating point number. This three byte field consists of a 7-bit exponent, a sign bit, and a 16-bit fraction. See Section 3.
Red Tag	A logical flag used to indicate a point is out of service. Any value reported from this point is not valid until the red tag is removed.
Remote Control Memory (RCM)	A NETWORK 90 function block that implements a logical switching function. The CIU allows the host to read and set RCM points in remote PCUs through the RCM Read Point Type.
Remote Control Memory Report	A CIU Point Type that allows the host to simulate an RCM function block configured in the CIU.

Remote Manual Set Constant (RMSC)	A NETWORK 90 function block which generates exception reports consisting of a status and an analog value.
Reply Code	A byte field in the reply to a CIU command indicating whether or not the command was accepted and performed (ACKed) or rejected and not performed (NAKed). NAK codes generally indicate why the command failed (see Table 2).
Report Point	A point established in the CIU with ESTABLISH REPORT. These points appear as function blocks configured in the host to other NETWORK 90 nodes. This enables the host to send exception reports to modules which have established and connected exception report routes.
Sample Number	A sequence number used to synchronize trend data with NETWORK 90 system time.
Secondary	Synonymous with off-line. With redundancy, this refers to the backup CIU.
Sequence of Events Recorder (SER)	NETWORK 90 component that produces a printed log of time-tagged critical events during a plant or process shutdown. SER data is available through the CIU via READ EXTENDED PROBLEM REPORT.
Specifications	NETWORK 90 function block characteristics are determined by specification values. These are entered into the module when the point is configured, or in the case of tuneable specifications, when the function block is tuned. Specifications are sent out to other modules when exception report routes are established, and when the specifications are changed.
Station Set Point (SP)	Analog input to a NETWORK 90 station function block. The Set Point variable may be both read and written by the host through the CIU.
Station Variable	A value that is read from or written to a Station block. These include Set Point, Process, Control Output, or Ratio Index variables.

Status	Data byte(s) that indicate the operating condition of a NETWORK 90 point, module, or node. The bits of the status byte(s) are encoded to specify various conditions or modes that apply to the point, module, or node. Interpretation of these bits depends on the NETWORK 90 entity to which the status refers. The Appendix of this manual should be consulted whenever a status field appears in a CIU command or reply.
Time Sync	A mechanism for synchronizing a NETWORK 90 system to a common clock.
Two's Complement Value	A value obtained by performing a two's complement operation on an integer value, expressed in binary format. In NETWORK 90 systems, this is equivalent to the negative of the original integer. For example, the two's complement of the byte quantity 0000111 (7 base 10) is 11111001 (-7 base 10).
Watchdog Timer	A timer set to check on the progress of an operation in the CIU. For example, the CIU uses a watchdog timer to periodically check the status of host communications. If this option is enabled in CIU RESTART, and the host has not communicated with the CIU during the watchdog timing period, the CIU goes off-line.
Work Flag	A status byte. The bits of the Work Flag are encoded to provide the host with information about the receipt of time synch messages, specifications, and exception reports by the CIU. See READ WORK FLAG in Section 2.
X-ON/X-OFF Protocol	A protocol that enables a receiving device to start and stop the flow of serial data from a transmitting device. This is accomplished by transmitting control characters from the receiving device. X-ON starts data transmission. X-OFF stops data transmission.

Remote Manual Set Constant (RMSC)	A NETWORK 90 function block which generates exception reports consisting of a status and an analog value.
Reply Code	A byte field in the reply to a CIU command indicating whether or not the command was accepted and performed (ACKed) or rejected and not performed (NAKed). NAK codes generally indicate why the command failed (see Table 2).
Report Point	A point established in the CIU with ESTABLISH REPORT. These points appear as function blocks configured in the host to other NETWORK 90 nodes. This enables the host to send exception reports to modules which have established and connected exception report routes.
Sample Number	A sequence number used to synchronize trend data with NETWORK 90 system time.
Secondary	Synonymous with off-line. With redundancy, this refers to the backup CIU.
Sequence of Events Recorder (SER)	NETWORK 90 component that produces a printed log of time-tagged critical events during a plant or process shutdown. SER data is available through the CIU via READ EXTENDED PROBLEM REPORT.
Specifications	NETWORK 90 function block characteristics are determined by specification values. These are entered into the module when the point is configured, or in the case of tuneable specifications, when the function block is tuned. Specifications are sent out to other modules when exception report routes are established, and when the specifications are changed.
Station Set Point (SP)	Analog input to a NETWORK 90 station function block. The Set Point variable may be both read and written by the host through the CIU.
Station Variable	A value that is read from or written to a Station block. These include Set Point, Process, Control Output, or Ratio Index variables.

Status	Data byte(s) that indicate the operating condition of a NETWORK 90 point, module, or node. The bits of the status byte(s) are encoded to specify various conditions or modes that apply to the point, module, or node. Interpretation of these bits depends on the NETWORK 90 entity to which the status refers. The Appendix of this manual should be consulted whenever a status field appears in a CIU command or reply.
Time Sync	A mechanism for synchronizing a NETWORK 90 system to a common clock.
Two's Complement Value	A value obtained by performing a two's complement operation on an integer value, expressed in binary format. In NETWORK 90 systems, this is equivalent to the negative of the original integer. For example, the two's complement of the byte quantity 0000111 (7 base 10) is 11111001 (-7 base 10).
Watchdog Timer	A timer set to check on the progress of an operation in the CIU. For example, the CIU uses a watchdog timer to periodically check the status of host communications. If this option is enabled in CIU RESTART, and the host has not communicated with the CIU during the watchdog timing period, the CIU goes off-line.
Work Flag	A status byte. The bits of the Work Flag are encoded to provide the host with information about the receipt of time synch messages, specifications, and exception reports by the CIU. See READ WORK FLAG in Section 2.
X-ON/X-OFF Protocol	A protocol that enables a receiving device to start and stop the flow of serial data from a transmitting device. This is accomplished by transmitting control characters from the receiving device. X-ON starts data transmission. X-OFF stops data transmission.

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