

INSTALLATION

4570K11-001A

Supersedes 4570K11-001

Bailey

a subsidiary of Babcock & Wilcox, U.S.A.
BAILEY METER COMPANY
WICKLIFFE, OHIO 44092

TYPE 701 BASIC CONTROLLER

WARNING

INSTRUCTION MANUALS

DO NOT INSTALL, MAINTAIN OR OPERATE THIS EQUIPMENT WITHOUT READING, UNDERSTANDING AND FOLLOWING PROPER Bailey Babcock & Wilcox INSTRUCTIONS AND MANUALS. OTHERWISE INJURY OR DAMAGE MAY RESULT

RADIO FREQUENCY INTERFERENCE

MOST ELECTRONIC EQUIPMENT IS INFLUENCED BY RADIO FREQUENCY INTERFERENCE (RFI). CAUTION SHOULD BE EXERCISED WITH REGARD TO THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT IN THE AREA. PRUDENT PRACTICE DICTATES THAT CAUTIONING AGAINST THE USE OF PORTABLE COMMUNICATIONS EQUIPMENT BE TAKEN BY POSTING APPROPRIATE SIGNS IN YOUR PLANT

This publication provides the instructions necessary to initially install and operate Type 701 Basic Controllers. If additional information relating to the operation and maintenance of the controller is required, refer to Bailey Service Manual, 4570K11-300.

INTRINSICALLY SAFE APPLICATIONS

Controllers for use in Intrinsically Safe Systems have an "X" or "Y" in the tenth digit of the catalog number stamped on the rating plate. Controllers for these applications must be installed, connected, and energized in strict accordance with the requirements of Intrinsically Safe Systems publication, 4579K10-001 (U.L.) or 4579K10-002 (C.S.A.).

WARNING

THIS DEVICE MUST BE LOCATED IN A NONHAZARDOUS AREA IN INTRINSICALLY SAFE SYSTEMS APPLICATIONS.

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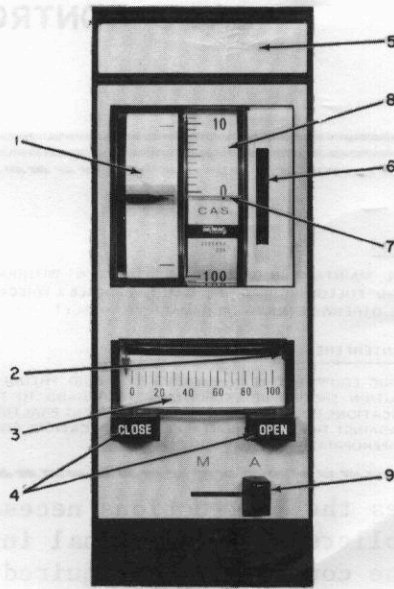
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INTRODUCTION

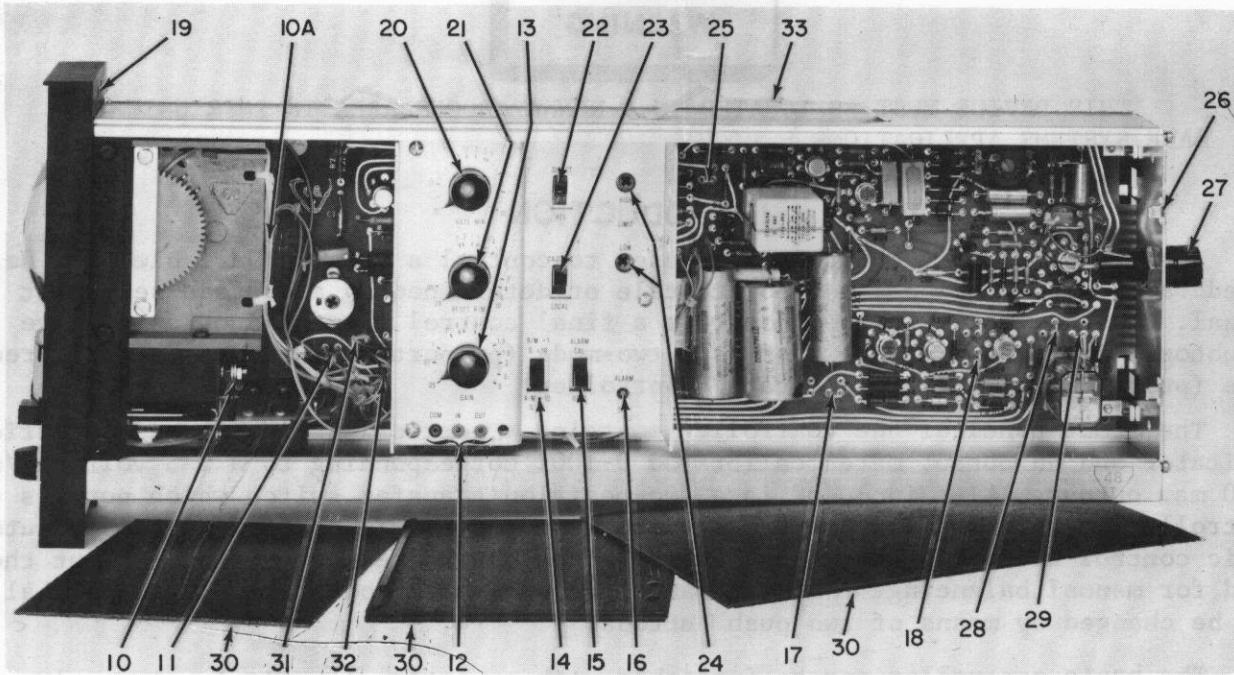
The Type 701 Basic Controller is used to control a process variable at a desired value set on a local set-point scale or determined by a cascade set-point signal. The controller output controls a final control element such as a valve actuator. It is furnished either as a two-mode (proportional and reset) or three-mode (proportional, reset, and rate) controller.

The front panel of the controller contains a vertical set point and deviation indicator and an output meter calibrated 0-100% corresponding to a 1-5 volt and/or 4-20 ma. output. Also included is a two-position transfer switch which permits the controller to be changed from automatic to manual control, or from manual to automatic control without producing a "bump" in the controller output and without the need for manual balancing. When in manual control, the controller output signal can be changed by means of two push buttons.

The basic controller may be furnished with an optional built-in alarm circuit which can be used to actuate external warning devices and/or internal alarm lamps located behind the controller translucent legend plate. The alarm circuit can be modified by internal jumpers to provide various forms of deviation or process variable alarms.



Front View



Side View

Fig. 1. Type 701 Basic Controller

LEGEND FOR FIG. 1

1. Deviation Meter -- Indicates difference between set-point and process-variable signals.
2. Output-meter Memory Pointer.
3. Output Meter -- Indicates value of controller output signal.
4. Push Buttons for manual control of output signal (reversible).
5. Legend Plate -- Translucent, with two optional lamps mounted behind legend.
6. Set-point Adjusting Thumbwheel.
7. Set-point Index.
8. Set-point Scale (and Drum).
9. Manual/Automatic (M/A) Transfer Switch.
10. Output Meter Mechanical Zero Adjustor. (Between terminal studs.)
- 10A. Deviation Meter Mechanical Zero Adjustor. (On opposite side.)
11. Green Lead for Parallel or Separate Lamp Connections.
12. Input and Output Test Jacks.
13. GAIN Control.
14. Control Action Range Switch.
15. ALARM CAL/OPER Switch -- for optional alarm adjustments.
16. ALARM/CAL Adjustor -- for adjusting optional alarm.
17. Process Variable Alarm Selection Jumpers.
18. Hi/Lo Deviation-Alarm Selection Jumpers.
19. Access Holes for Lamp, Legend, and Filter Replacement.
20. RATE Control (Optional).
21. RESET Control.
22. DIRECT/REV Switch -- Switches polarity of input signal to make controller a direct- or reverse-acting controller.
23. CASCADE/LOCAL Switch -- Permits set-point signal to be taken from internal (LOCAL) or external (CASCADE) source.
24. Output Limit Adjustors (HI/LO).
25. Control Action Modifier (In/Out) Jumper.
26. Connector Contacts (Terminals).
27. Fuse Holder.
28. Alarm Contact Jumpers.
29. A/E (Alarm/External) Lamp Jumper
30. Covers.
31. Yellow Lead for Remote M/A Transfer.
32. Violet and Brown Leads for Manual Direct/Reverse Action.
33. Spring Latch.

DESCRIPTION

The controls, adjustments, switches, meters, and other parts required for operating and servicing the controller are identified in the front and side views shown in Fig. 1.

RECEIVING

Immediately on receipt of the controller, examine it for any damage which may have occurred in transit. Immediate examination is especially important if rough handling is evident. If damage is found, a damage claim should be filed immediately with the transportation company and the nearest Bailey sales office should be notified. The shipping container should be retained by the user to assist in evaluating the damage to the controller or for storage and reshipment.

HANDLING

The controller is a rugged electronic unit, weighing approximately 5 pounds. Observe normal precautions for electronic equipment during handling.

STORAGE

If the controller is to be stored prior to use, repack it in its original packing material and container, if possible. Store it in an area free of corrosive vapors and extremes in temperature.

SHIPMENT

To provide adequate protection for the controller when shipping it from one location to another, or returning it to the factory, it should be packed in the original packing. If this packing is not available, float the controller in a box large enough to permit four to five inches of wedging with shredded paper, rubberized hair or equivalent. Use a method of shipment which will insure that normal precautions for electronic equipment are observed.

INSTALLATION

GENERAL

Type 701 Basic Controllers are designed to be installed in Bailey Type 762 panel-mountable shelves. They are interconnected to other devices and/or to other components in a control system by means of Bailey Type 763 cables. For information concerning installation of shelves and cables, refer to Bailey publication 4576K11-001.

CONNECTIONS

External connections are made by means of either terminal board-terminated cables (Type 7631 cable, connector, and TB assembly) as shown in Fig. 2 or extended cable-terminated cables (Type 7632 cable and connector assembly) as shown in Fig. 3. If a Type 709 Manual By-Pass Unit is to be used with the controller, terminal board-terminated cables with bypass capability or extended cables with bypass capability as shown in Fig. 4 and 5 must be used for external connections. (Refer to publication 4570K19-001 for information concerning the By-Pass Unit.) Refer to Table I which shows external connections to the terminal board and color identification of cable conductors for connecting extended cables to customer-supplied remote terminals.

After external connections have been made, the controller is connected into the system by plugging the cable connector onto the terminal end of the controller circuit board, which protrudes through the rear of the controller chassis.

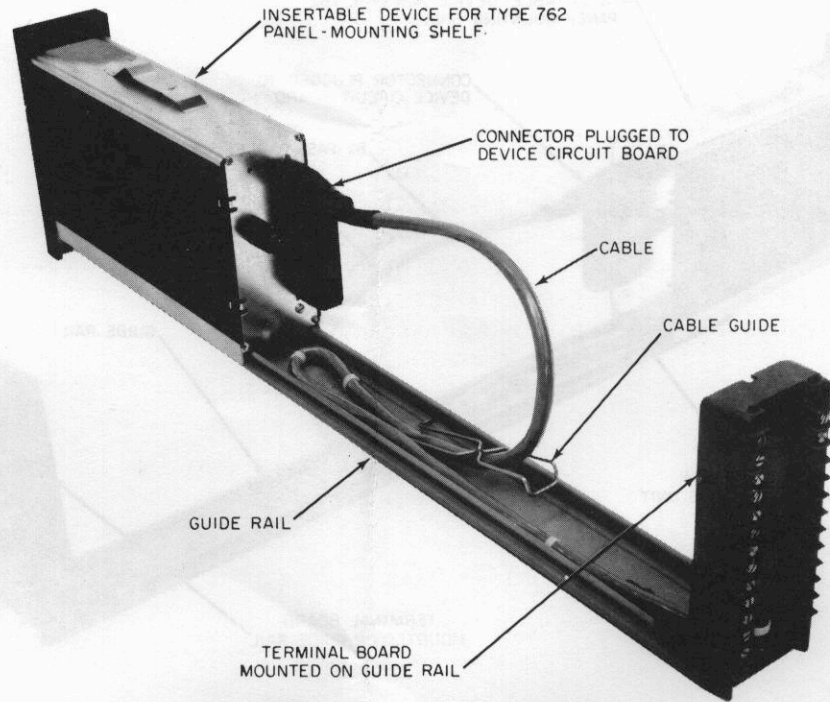


Fig. 2. Connections Using Type 7631 Cable, Connector, & TB Assembly

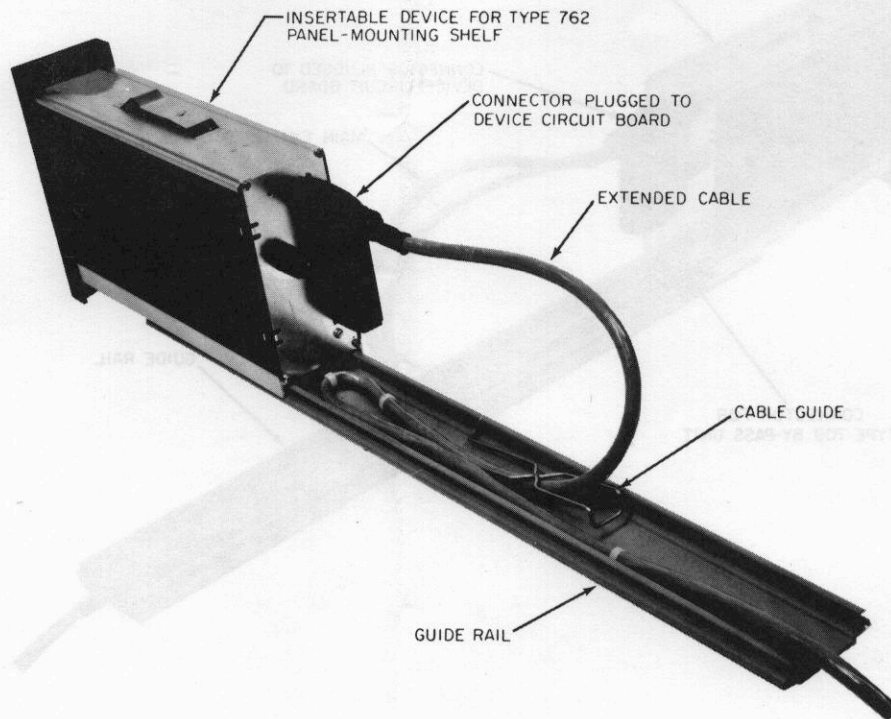


Fig. 3. Connections Using Type 7632 Extended Cable

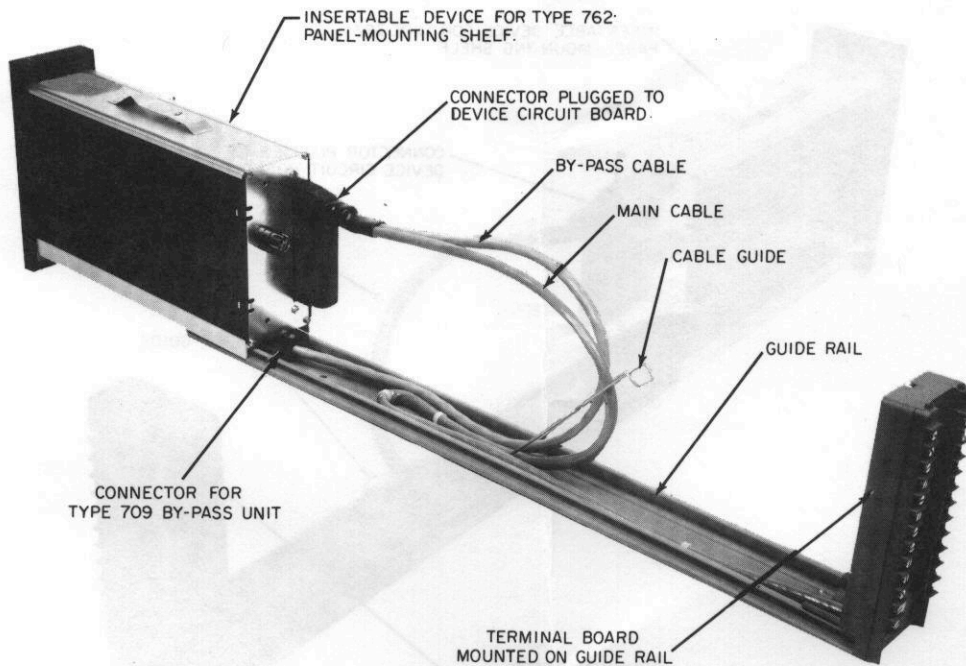


Fig. 4. Connections Using Type 7631 Cable, Connector and TB Assembly with By-Pass Capability

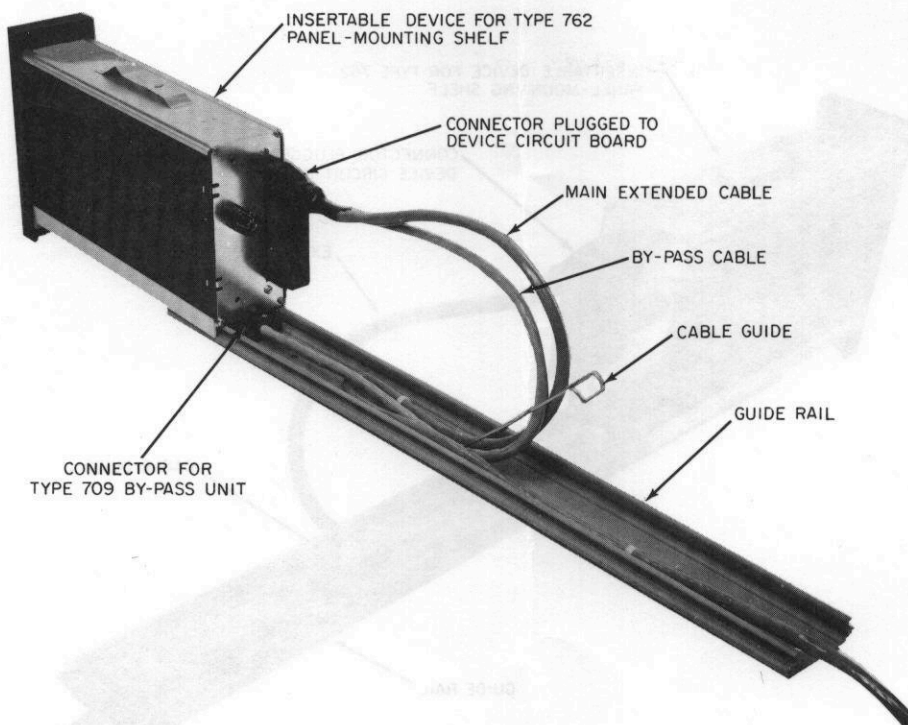


Fig. 5. Connections Using Type 7632 Extended Cable with By-Pass Capability

TABLE I
EXTERNAL CONNECTIONS

Terminal Number (Terminal Board- Terminated Cable Only)	Cable Conductor Color	External Connections	Notes
1	Green	Earth Ground	
2	Red	+24VDC Supply	
3	Black	Supply Common	Connect to system signal common
4	White	Signal Common	Connect to system signal common
5	Orange	Process Input Signal 1-5VDC	
6	Blue	Cascade Input Signal 1-5VDC	
7	White/Black	Output Signal 1-5VDC	Load must exceed 0.25 meg.
8	Red/Black	Output Signal 4-20 MA. (+)	} Allowable load is 0-750 ohms connect 8 to 9 if no load is required.
9	Green/Black	Output Signal 4-20 MA. (-)	
10	Orange/Black	+24VDC Output	Fused internally by 1-amp con- troller power fuse. Load max. = 0.2 amp.
11	Blue/Black	Alarm Contact	} For external alarm display
12	Black/White	Alarm Contact	
13	Red/White	Right Light +24VDC	} For operation of lights from external source.
14	Green/White	Left Light +24VDC	
15	Blue/White	Remote Transfer	For remote M/A transfer. Open for Manual; closed for Auto.

The controller may then be inserted into the panel-mounted shelf by sliding the bottom rails over the guide rails in the shelf and at the same time depressing the spring latch on top of the controller chassis. If the controller is partially withdrawn from the front of the shelf in order to make adjustments to side controls, it remains connected by means of a short loop of the flexible cable.

INITIAL CHECKS & ADJUSTMENTS

WARNING

DO NOT USE BATTERY-OPERATED OR LINE-OPERATED TEST INSTRUMENTS TO TEST OR ADJUST DEVICES WHICH ARE CONNECTED IN AN INTRINSICALLY SAFE SYSTEM. ANY SUBSTITUTION OF PARTS MAY IMPAIR INTRINSIC SAFETY.

* * *

INITIAL CHECK

Unless otherwise specified by the customer, the controller is shipped with the circuit board wired for the modes of operation which are specified as "Standard" in Table II. Check to make sure that the circuit board wiring corresponds to the desired operating mode.

If it is desired to change the circuit board wiring in order to select a different mode of operation, refer to Table II for the specific jumper and/or lead changes to be made.

CAUTION

Do not make wiring changes to the circuit board while connected to the process system. Disconnect the controller from the cable connector before making wiring changes.

The staple-type jumpers can be easily removed and inserted with long-nose pliers. The plug-and-jack type lead connections can be disconnected and connected by hand. Make sure to disconnect and connect the lead jacks in a straight up-and-down manner. Do not apply sideways pressure or otherwise bend or twist the lead jacks.

Light Filters, Legend Plate and Lamp Replacement

Unless otherwise specified by the customer, the controller is supplied with white indicating lights. However, if desired, either light may be colored red, amber, green, or blue by means of the filters supplied with the controller. Legend plates are supplied blank or marked with customer-specified legends. To change filters, legend plates, or lamps proceed as follows:

1. Insert a small-head screwdriver through the two access holes (19, Fig. 1) at the rear of the front frame to push out the legend and lamp-holder assembly (5, Fig. 1).
 - a. To replace a legend plate, slide the plate out of the legend and lamp-holder assembly and replace by sliding it back into the assembly. Make sure that the legend plate does not extend beyond the edge of the holder.
 - b. To change filters, insert the desired filters for both the left and right lights by sliding them into the slot behind the legend plate.
 - c. To replace lamps, snap the burnt-out lamp out of the lamp holder and replace with a GE Type 327 lamp. Make sure that the lamp holder is centered in the legend holder.

TABLE II
CONTROLLER OPERATING OPTIONS

<u>Mode of Operation</u>	<u>Description</u>	<u>Circuit Board Wiring</u>
<u>INDICATING LIGHTS</u>		
Parallel external lights (Standard without alarm)	Lights operate in parallel from external source.	Jumper pinned to E. Green lead connected to J25.
Separate external lights	Left and right lights operate separately from external source.	Jumper pinned to E. Green lead connected to J27.
Parallel alarm lights (Standard with alarm)	Left and right lights are operated by internal alarm circuit.	Jumper pinned to A. Green lead connected to J25.
Right alarm light	Right light is operated by internal alarm circuit. Left light operates separately from external source.	Jumper pinned to A. Green lead connected to J27.
<u>ALARMS</u>		
HI & LO Deviation Alarm (Standard)	Deviation alarm is actuated if either a positive or negative deviation reaches a preset alarm-point value between 2% and 20% of set-point span.	Jumper pinned to D,D,HD, and LD.
HI Deviation Alarm	Same as above, except actuation is only for high deviation between +2% and +20%.	Jumpers pinned to D,D,HD, and H.
LO Deviation Alarm	Same as above, except actuation is only for low deviations between -2% and -20%.	Jumpers pinned to D,D,LD, and L.
HI Process Variable Alarm	Process variable alarm is actuated if process variable exceeds a preset alarm point.	Jumpers pinned to P,P,HD, and H.
LO Process Variable Alarm	Process variable alarm is actuated if process variable drops below a preset alarm point.	Jumpers pinned to P,P,LD, and L.
Alarm contacts closed in alarm condition (Standard)	Closed circuit to external when in alarm condition.	Jumper pinned to C.

TABLE II (CONT.)

<u>Mode of Operation</u>	<u>Description</u>	<u>Circuit Board Wiring</u>
<u>ALARMS (CONT.)</u>		
Alarm contacts open in alarm condition	Open circuit to external contacts when in alarm condition.	Jumper pinned to 0.
<u>REMOTE M/A TRANSFER</u>		
Without remote M/A transfer (Standard)	Manual to automatic transfer accomplished by front panel M/A switch.	Yellow lead connected to J29.
With remote M/A transfer	Manual to automatic transfer accomplished by remote 24VDC signal when M/A switch is at A.	Yellow lead connected to J28.
<u>CONTROL ACTION MODIFIER</u>		
Without control action modifier circuit (Standard)	Standard control action (Proportional + Reset + Rate).	Jumper pinned to OUT.
With control action modifier circuit	Reset action only.	Jumper pinned to IN.
<u>MANUAL DIRECT/REVERSE</u>		
Direct manual operation (Standard)	Pressing right-hand push button causes increase in controller output. (Output meter goes upscale.)	Violet lead connected to J13. Brown lead connected to J15.
Reverse manual operation	Pressing right-hand push button causes decrease in controller output. (Output meter goes downscale.)	Violet lead connected to J15. Brown lead connected to J13.
<u>MANUAL PUSH BUTTONS</u>		
Standard push button positions	OPEN - Right CLOSE - Left	
Optional push button positions	CLOSE - Right OPEN - Left	

2. Insert the legend- and lamp-holder assembly into the controller front frame and press to lock into the frame.

PRELIMINARY CONTROL SETTINGS

Set switches and controls as specified in Table III.

TABLE III

<u>Control</u>	<u>Fig. 1 Reference</u>	<u>Standard Position</u>	
CASCADE/LOCAL Switch	23	LOCAL	Set to CASCADE for cascade operation.
DIRECT/REV Switch	22	REV	Set to DIR if it is required that the controller output increase with an increase in process variable input.
ALARM CAL/OPER Switch	15	OPER	
X1/X10 Switch	14	R/M X 1; G X 10	Set to R/M X 10, G X 1 for flow applications.
GAIN control	13	0.1	Set to 0.4 for flow applications.
RESET control	21	Complete-ly counter-clockwise	
RATE control (if used)	20	Complete-ly counter-clockwise	

OUTPUT LIMIT ADJUSTMENT

The controller output limits are set at the factory for HI operation at 100% of scale and LO operation at 0% of scale. The following procedure can be used to adjust these limits to other values if desired. The limits should be adjusted with the RESET control set approximately to the operating point.

NOTE

The following limit adjustment procedure with the controller connected to the process will cause the final control element to operate unless it is blocked or a Type 709 Manual By-Pass Unit is used. If this is not acceptable, the adjustments must be made on a test bench with a supply voltage of 24VDC connected to terminals 2 and 3, a signal source of 1 to 5VDC connected to terminals 4 and 5, and a jumper connected to terminals 8 and 9.

1. Set the M/A switch to A. Set the CASCADE/LOCAL switch to LOCAL.
2. Rotate the thumbwheel (6, Fig. 1) to drive the output-meter pointer above the desired high limit.

3. Adjust HI limit adjustor (24, Fig. 1) to the position which limits the controller output at the desired HI value.
4. Rotate the thumbwheel to drive the output-meter pointer below the desired low limit.
5. Adjust LO limit adjustor (24, Fig. 1) to the position which limits the controller output at the desired LO value.
6. For cascade operation, reset the CASCADE/LOCAL switch to CASCADE.

OPERATION

MANUAL OPERATION

With M/A switch set to M, adjust the controller output by means of the manual push buttons to bring the valve or the process variable to the desired value. The output signal to the valve is indicated on the output meter. The process variable can be measured by adjusting the deviation meter to null and reading the scale when the CASCADE/LOCAL switch (23, Fig. 1) is on LOCAL.

When the controller is wired for direct manual operation as specified in Table II, pressing the right-hand push button will cause an increase in controller output as indicated by an increasing output meter indication. An increase in the controller output will cause a direct-operated valve to open and a reverse-operated valve to close. When the controller is wired for reverse manual operation, pressing the right-hand push button will cause the controller output to decrease. For a slow change in output, press the push buttons lightly. For a fast change, press the push buttons hard.

MANUAL/AUTOMATIC TRANSFER OPERATION

The controller can be transferred from manual to automatic or from automatic to manual operation using the M/A switch (9, Fig. 1) without producing a process "bump". If there is a difference between the process variable and the set-point values, a transfer from manual to automatic will cause a change in output at the reset rate to bring the process to the set-point value. A transfer from automatic to manual will cause the output to be held at the value prior to transfer. If the controller is wired for the remote transfer option, the M/A switch must be in position A to transfer from manual to automatic operation.

AUTOMATIC CONTROL OPERATION

1. Set the X1/X10 control range switch and the GAIN, RESET, and RATE (if used) controls to known values required for the process control loop. If these values are not known, retain the settings specified under "Preliminary Control Settings".
2. For local control, set the set-point to the desired value of the process variable. For cascade control, set the set point below the minimum scale value.
3. Transfer from manual to automatic control by setting the M/A switch to A.
4. For local set-point control, the deviation meter indicates the difference between the process variable and the set-point scale. For cascade control, the meter indicates the difference between the process variable and the cascade set point.

5. For further information concerning additional adjustments to tune the controller for the best control action, refer to Service Manual 4570K11-300.

CASCADE/LOCAL TRANSFER OPERATION

To transfer from local to cascade control or from cascade to local control without producing a process "bump", set the M/A switch to M before operating the CASCADE/LOCAL switch (23, Fig. 1). If there is a difference between the cascade set point and the local set point, the output will change at the reset rate when the M/A switch is set to A.

ALARM OPERATION

If the controller is supplied with an optional internal alarm, set the operating point for the deviation alarm or process-variable alarm as follows. Refer to Table II to determine the mode of operation of the alarm and lights.

Deviation Alarm

1. Set the M/A switch (9, Fig. 1) to M.
2. Set the ALARM CAL/OPER switch (15, Fig. 1) to OPER. Set the CASCADE/LOCAL switch (23, Fig. 1) to LOCAL.
3. With the process-variable input signal at a steady value, turn the thumbwheel until the red pointer and red index line on the deviation meter coincide (i.e., indicate zero deviation). Record the set-point scale reading for reference purposes.
4. Rotate the thumbwheel upscale for HI and for HI/LO deviation alarm and downscale for LO deviation alarm, until the set-point scale indicates the percent deviation desired (within the limits of ± 2 to ± 20 percent of the set-point span).
5. Turn the ALARM CAL adjustor (16, Fig. 1) in a clockwise direction for HI alarm or counterclockwise direction for LO alarm until the alarm operates.
6. Rotate the thumbwheel to reset the set-point scale back to the desired set-point value. For cascade operation, reset the CASCADE/LOCAL switch to CASCADE.
7. For automatic control, reset the M/A switch to A.

Process Variable Alarm

1. Set the M/A switch to M.
2. Set the ALARM CAL/OPER switch to CAL. Set the CASCADE/LOCAL switch (23, Fig. 1) to LOCAL.
3. Rotate the thumbwheel until the desired scale value for the alarm is indexed on the set-point scale. This will be a high alarm operating point if the circuit board is wired for HI process variable alarm, and a low alarm operating point if wired for LO process variable alarm.
4. Turn the ALARM CAL adjustor (16, Fig. 1) in a clockwise direction for HI alarm or a counterclockwise direction for LO alarm, until the alarm operates.

5. Rotate the thumbwheel to reset the set-point scale back to the desired set-point value. Set the ALARM CAL/OPER switch back to OPER. For cascade operation, reset the CASCADE/LOCAL switch to CASCADE.

6. For automatic control, reset the M/A switch to A.

Product Warranty

Bailey Meter Company warrants the products manufactured by it to be free from defects in material and workmanship and will repair or replace, at its option, free of charge, f.o.b. its factory, such part or parts which prove defective within one year from date of shipment. In respect to any products which are not an integral part of a product manufactured by the Company, the warranty given by the manufacturer thereof shall apply.

Shipping Damage

We strongly recommend that you inspect and test your instrument as soon as you receive it. If the instrument is damaged or operates improperly, notify the carrier for inspection of the shipment. The carrier's claim agent will prepare a report of damage, a copy of which should be forwarded to your nearest Bailey District Office (see back cover for location). The District Office will then tell you how to have the instrument repaired or replaced.

Service

The Bailey Meter Company is vitally concerned that your Bailey instrument provides continued, fine performance. This instruction manual is designed to fully describe the correct installation, operation, and maintenance of your instrument under recommended conditions. If the need arises, factory-trained Service Engineers are on call for prompt, in-plant maintenance. Telephone or wire your nearby Bailey District Office to make arrangements for this service.

Replacement Parts and Supplies

When replacement parts or supplies are required for maintenance of your Bailey instrument, contact your nearest Bailey District Office (see back cover for location). Always specify complete data on the instrument nameplate on your inquiry or order for parts. Common parts are available for shipment within 48 hours on a speed-order basis.

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