

MODBUS Communications for
MODCELL 2050R
Indicating Process Controller

**User's Guide
Supplement**

2050R Model B Version 2.8

2051R Model B Version 2.8



MicroMod Automation, Inc.

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INTRODUCTION

INTRODUCTION

About This Supplement

This supplement provides instructions for installation, setup, and use of the Modbus RS-485 serial communications option available in the MODCELL 2050 Single Loop Controller. Comprehensive instructions covering all aspects of the controller not related to Modbus communication are included in the **IB-23C650 User's Guide**.

Specific information provided in this supplement is as follows:

- Instructions for connecting the controller to a Modbus network using either a 2-Wire or 4-wire configuration.
- Application information including controller operation as a supervisory station or computer auto/manual station using Modbus communications.
- Step-by-step instructions for setup of the communications function using the RS-485 MENU in the controller data base.
- Operating instructions for the controller when Modbus communication with a host device is enabled.
- A description of the Modbus messages supported and the message formats.
- Controller attribute reference data. The listing includes register data for numeric attributes and coil data for boolean (discrete) attributes.

About Modbus Communications

A 2050R controller and a host device connected to a Modbus network communicate via a master/slave relationship. The host device functions as the Modbus master and the controller functions as the slave. The master is in command of the communications transaction and talks to one slave (controller) at a time. The master sends a message to a slave and waits to receive an answer back from that slave before it talks to the another slave. Each slave has a unique address which

INTRODUCTION

allows it to be identified by the master. This permits multiple slaves (controllers) to reside on a single Modbus network.

The controller can be assigned any address between 1 and 247. Addresses are set in the RS-485 MENU as part of the setup for modbus communication. Address 0 is the "broadcast" address. Only write messages can use it. All controllers process the message, but there is no response back to the host.

Other types of slaves may reside on a network with the controllers. Modbus does not support peer-to-peer communications where two controllers can talk directly with each other.

INSTALLATION

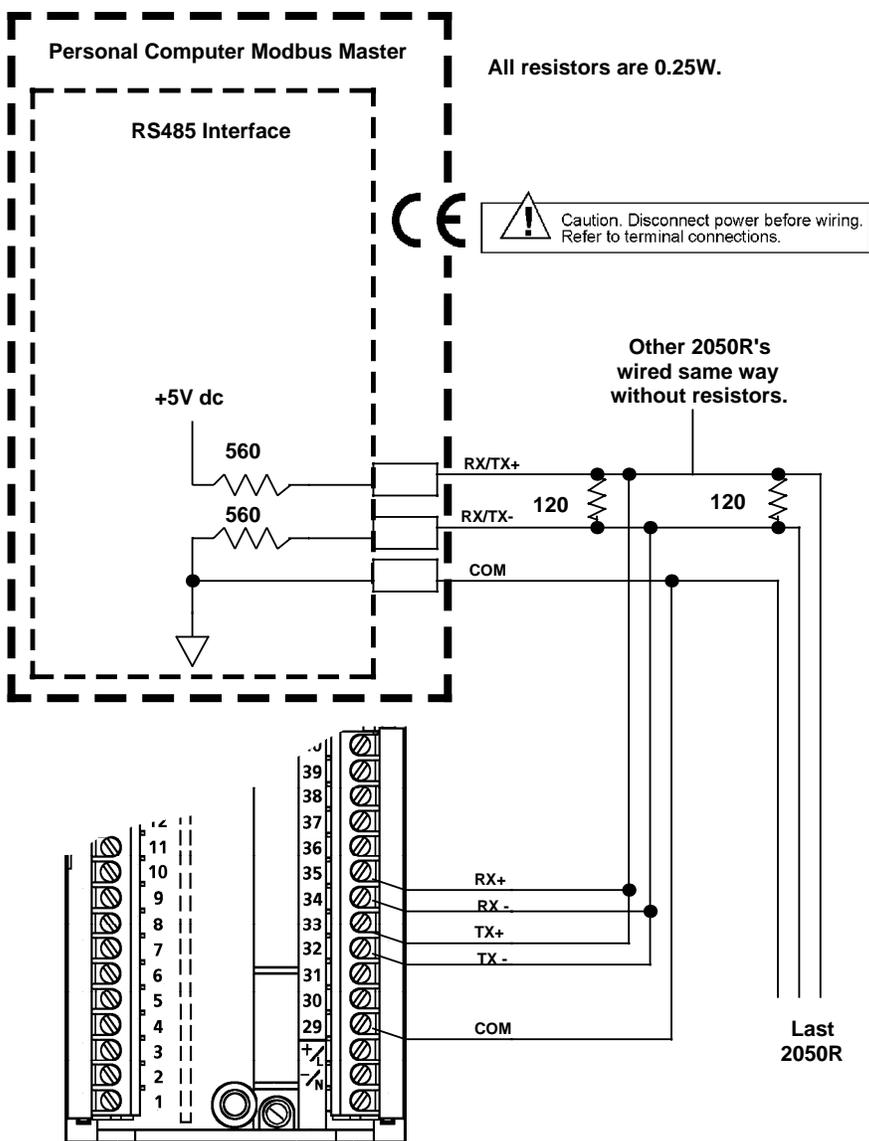


Figure 1. Typical 2-Wire Modbus Network Connections.

INSTALLATION

4-Wire Modbus Network Connections

Connections for typical Modbus networks using a 4-wire configuration are shown in Figures 2 and 3. The host device functions as the master and the controllers function as slaves. It is recommended that no more than 32 devices be connected on a single network. The number of devices can be increased by the use of repeaters.

When the host is a device such as a personal computer, the instruments and host must have a common ground as shown in Figure 2. When the host is a MODCELL Multiloop Processor, Figure 3, connection of the processor to the instrument common line is not required because the processor connections are optically isolated.

The master is responsible for providing the 560 ohm pull-up and pull-down bus stabilizing resistors. In the MODCELL processor, these resistors are provided in the RS-485 communications module, and the TERM switch on the module must be set at YES to connect the resistors to the network (see **IB-23C600 MODCELL Multiloop Processor Installation Instructions** for more information). Connect 120 ohm termination resistors across the transmission line at both ends as shown. The termination resistors may not be required if the line length is very short.

Cable requirements depend on the length of the run. For short runs of 10 to 25 ft (3 to 6m) virtually any 2-wire shielded or twisted pair is suitable. For runs up to 1000 ft (305m), Belden 9502 cable or equivalent is recommended. This cable is a dual 24 AWG twisted pair with an overall foil shield. A drain wire is provided for grounding the shield. For runs up to 4000 ft (1219m) Belden 9729 or equivalent is recommended. This cable is a dual 24 AWG twisted pair with a foil shield for each pair. The cable insulation is low dissipation (polypropylene). Two separate drain wires are provided for grounding the shields.

INSTALLATION

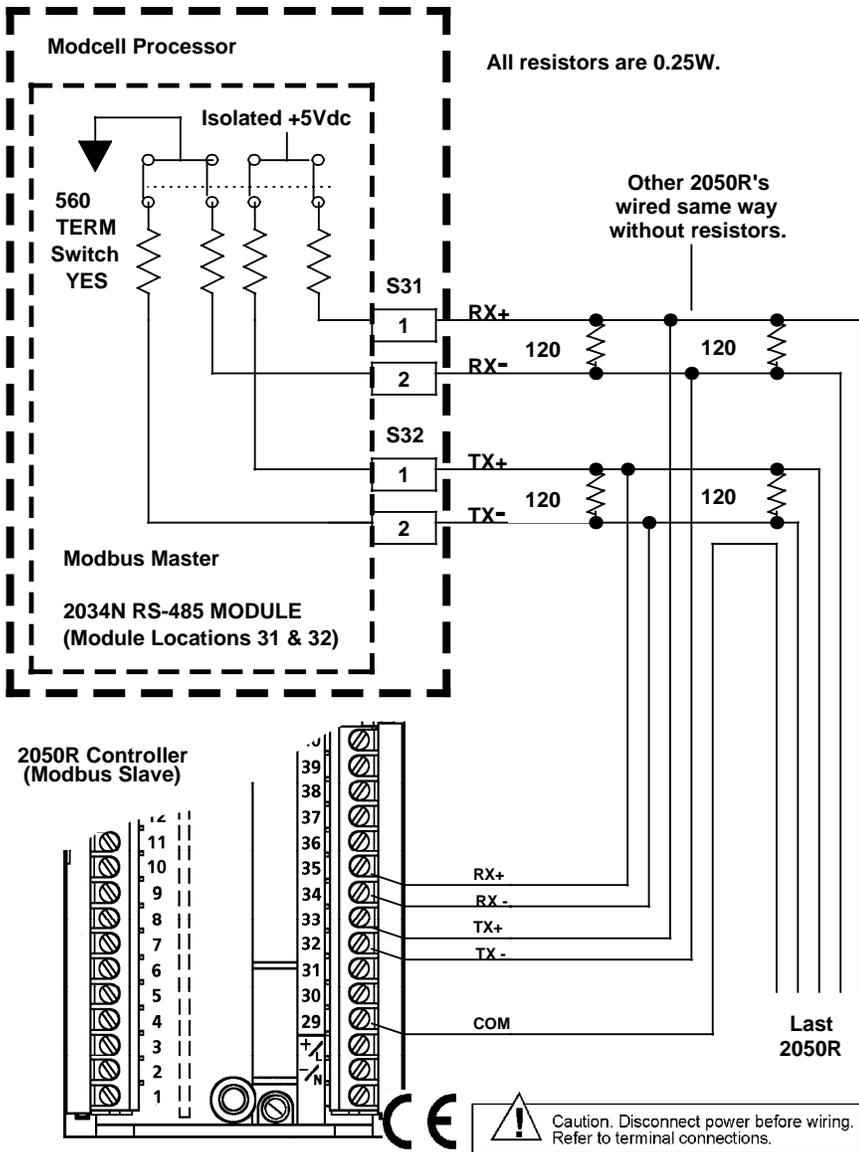


Figure 3. Typical 4-Wire Modbus Network Connections with a MODCELL Multiloop Processor as Master

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COMMUNICATION APPLICATIONS

COMMUNICATION APPLICATIONS

The following are sample applications available with the controller through the use of Modbus communications. The RS-485 MENU is used to set up the controller for these applications. The setup requirements are described in detail in Table 1.

Standard Control With Modbus Communications

For this application, the instrument acts as a stand alone single loop controller which can receive read/write commands from a host Modbus device such as a personal computer, MODCELL Multiloop Processor, PLC, etc. Multiple instruments and other devices can be on a single Modbus network. Each device on a network must have a unique address. The instrument address is assigned using the Bus Address attribute in the RS-485 MENU.

During runtime operation, the last attribute entry to the controller becomes the active entry. For example, if the operator sets an active set-point value via the instrument display and moments later the host sends a new active set-point value, the controller uses the operators value until it receives the host value. At that time the host value becomes the new active set-point value.

A prompt in the DISPLAYS MENU permits the operator to disable the host from writing to the controller. The host can still receive data from the instrument, but can not write to it. This is useful if the operator must maintain manual control of the process and does not want the host to write to the instrument. The operator can reinitiate the host write capacity via the DISPLAYS MENU when required.

The Computer Timeout attribute is not active in this application. When necessary, this attribute is initialized by the host as a means of notifying the instrument of a communication failure. In this application, failure of the host or the communications has no effect on instrument operation. The controller continues to operate with its current attribute values as if nothing happened.

Supervisory Control

The controller receives its set-point from the host device in a supervisory control application. All other aspects of controller operation are similar to standard control as described above. The PID control function is provided by the controller.

COMMUNICATION APPLICATIONS

Attributes in the RS-485 MENU permit the supervisory control mode to be indicated via the set-point status display on the front of the instrument. Each of the three characters in the status display is configurable so that the user can choose an appropriate mnemonic to represent the supervisory control mode.

A timeout value can be defined for communications traffic to the instrument via the Computer Timeout attribute. An activity timer in the instrument is initialized by the host when operation starts. This action also enables the configured set-point status display.

The timer monitors the communications bus for activity to the instrument within the specified timeout period. If there is no communications activity to the instrument during the specified time, a "computer failure" is declared. During a computer failure the controller assumes local control with I/O and mode states as defined under "Computer Failure Setup" in the RS-485 MENU.

When the controller is receiving a set-point from the host, the set-point status display can be configured to indicate that the host is the set-point source. The R/L key still performs its normal function. The set-point status display indicates changes in the set-point source (LOC, LO1, etc.).

Computer Control

In a computer control application, the instrument functions as a computer auto/manual station. The host performs the PID control function with the results communicated to the controller and then to the field.

Attributes in the RS-485 MENU permit the computer control mode to be indicated via the control and set-point status displays on the front of the instrument. Each of the three characters in each status display is configurable so that the user can choose appropriate mnemonics to represent the computer control mode and set-point status.

A computer timeout value is defined and a timer monitors communications in the same manner as for supervisory control. When the computer is active, the function of the AUTO, R/L and Manual keys can be configured to provide a signal to the computer upon which it can take some programmed action.

RS-485 COMMUNICATIONS SETUP

RS-485 COMMUNICATIONS SETUP

Before starting the communications setup, refer to the **Setup Section** in **IB-23C650** for information about the setup preparation, method, and controls. Perform the communications setup using the RS-485 MENU as described in Table 1.

Note: In order to access the RS-485 MENU, the RS-485 Communications Enable attribute in the BASE CONFIGURATION MENU must be set at YES. Refer to **Table 1, Base Configuration** in **IB-23C650**.

RS-485 COMMUNICATIONS SETUP*Table 1. RS-485 Setup Menu*

Step	Step Description	Top Display
1	RS-485 Menu. (requires option board) <i>UP</i> moves to RELAYS **MENU**. <i>DN</i> moves to RAT BIAS **MENU** if A/M ratio bias is enabled, or to SETPTS **MENU** otherwise. <i>SCRL</i> advances to Step 2 (read only in auto).	RS-485
2	Bus Enable <i>UP</i> or <i>DN</i> selects ON or OFF. <i>SCRL</i> to advance to Step 3.	BUS
3	Instrument Address <i>UP</i> or <i>DN</i> sets instrument address. <i>SCRL</i> to advance to Step 4.	BUS
4	Baud Rate <i>UP</i> or <i>DN</i> sets instrument baud rate. <i>SCRL</i> to advance to Step 5.	BAUD
5	Parity Selection <i>UP</i> or <i>DN</i> sets instrument parity. <i>SCRL</i> to advance to Step 6.	PARITY
6	Stop Bit Selection <i>UP</i> or <i>DN</i> sets number of stop bits. <i>SCRL</i> to advance to Step 7.	STOP
7	Allowed Access Type <i>UP</i> or <i>DN</i> sets communications access type. <i>SCRL</i> to advance to Step 8.	ACCESS

RS-485 COMMUNICATIONS SETUP

Table 1. RS-485 Setup Menu

Middle Display	Bottom Display	Entry Description
MENU		None.
ENABLE	ON OFF	= enables the bus for communications with a host device. = disables the communications bus from receiving or writing with a host device. The bus must be disabled in order to make changes in the following steps.
ADDRESS	XXX	Where X is any address between 1 and 247. Each instrument on a bus must have a unique address.
RATE	XXXX	Where X is one of the following baud rates; 150, 300, 1200, 2400, 4800, 9600, 19200, 38400. All devices on the same bus must have the same baud rate.
SELECT	ODD EVEN	= Parity calculation is odd. = Parity calculation is even. Note: Total word length equals start bit (1) + data (8 bits) + parity (1) + stop bits (1/2). Total word length can be 11 or 12 bits.
BITS	1 2	= One stop bit appended to character. = Two stop bits appended to character.
TYPE	RD_ONLY RD/WRITE	= Allows the host device to read only from the controller. = Allows the host device to read data from and write data to the controller.

RS-485 COMMUNICATIONS SETUP*Table 1. RS-485 Setup Menu*

Step	Step Description	Top Display
8	Computer Activity Setup. <i>UP</i> begins setup at Step 8.1. <i>SCRL</i> to advance to Step 9 (Enable Bus).	COMPUTER
8.1	Computer Activity Timeout. <i>UP</i> or <i>DN</i> sets value. <i>SCRL</i> to advance to Step 8.2.	COMPUTER
8.2	Computer Activity Mnemonic (Auto) <i>UP</i> or <i>DN</i> sets value (press <i>UP</i> to begin then press <i>UP</i> to start at A or press <i>DN</i> to start at 9). Press <i>SCRL</i> to access the next character. Repeat through the third character. Press <i>SCRL</i> after the third character to continue with step 8.3.	CMP AUTO
8.3	Computer Activity Mnemonic (Manual) <i>UP</i> or <i>DN</i> set values and <i>SCRL</i> accesses characters as described in Step 8.2. Press <i>SCRL</i> after the third character to continue with step 8.4.	CMP MAN

RS-485 COMMUNICATIONS SETUP

Table 1. RS-485 Setup Menu

Middle Display	Bottom Display	Entry Description
SETUP		Steps 8.1 through 8.12.6.1.1 allow setup for the controller to be used as a computer auto/manual (CAM) or supervisory station when connected to a host device. No entries are required if the instrument is to be used as a stand alone controller which can receive read/write commands from a host device.
TIMEOUT	XXXXXX	X represents a time between 1 and 16383 seconds. The computer activity timeout function is initialized and maintained by the computer (host). If the time between sessions of bus activity is greater than this value, a Computer Fail is declared. This causes the activity timer to be disabled, and the computer status reverts to LOCKED. The controller returns to local with parameters as defined in Step 8.12.
MNEMONIC	XXX	Where X = any of the following characters: Letters A through Z, Any of the special characters: b, c, super c, d, h, sub L, super L, super m, super n, o, r, super T, u, super V, w, <, >, =, +, -, *, #, /, %, degrees (super o), or space, Numbers 0 through 9. Mnemonic appears in the control mode status display when the activity timer is initialized by the host and control mode is automatic. Default mnemonic is CMP.
MNEMONIC	XXX	Where X = any of the characters listed in Step 8.2 Mnemonic appears in the control mode status display when the activity timer is initialized by the host and control mode is manual. Default mnemonic is MAN.

RS-485 COMMUNICATIONS SETUP

Table 1. RS-485 Setup Menu

Step	Step Description	Top Display
8.4.	Computer Control Mode Value <i>UP</i> or <i>DN</i> sets value. <i>SCRL</i> to advance to Step 8.5	COMPUTER
8.5	Computer Set-point Mnemonic (Local) <i>UP</i> or <i>DN</i> sets value (press <i>UP</i> to begin then press <i>UP</i> to start at A or press <i>DN</i> to start at 9. Press <i>SCRL</i> to access the next character. Repeat through the third character. Press <i>SCRL</i> after the third character to continue with Step 8.6.	CMP LOC
8.6	Computer Set-point Mnemonic (Local 2) <i>UP</i> or <i>DN</i> set values and <i>SCRL</i> accesses characters as described in Step 8.5. Press <i>SCRL</i> after the third character to continue with Step 8.7.	CMP LO2
8.7	Computer Set-point Mnemonic (Local 3) <i>UP</i> or <i>DN</i> set values and <i>SCRL</i> accesses characters as described in Step 8.5. Press <i>SCRL</i> after the third character to continue with Step 8.8.	CMP LO3

RS-485 COMMUNICATIONS SETUP

Table 1. RS-485 Setup Menu

Middle Display	Bottom Display	Entry Description
MODE VAL	XXX	Where X = any value between 0 and 255. This value is OR'd into bits 9-12 of the Control Mode register (#14) when the activity timer is enabled. Default value is 1.
MNEMONIC	XXX	Where X = any of the following characters: Letters A through Z, Any of the special characters: b, c, super c, d, h, sub L, super L, super m, super n, o, r, super T, u, super V, w, <, >, =, +, -, *, #, /, %, degrees (super o), or space, Numbers 0 through Mnemonic appears in the set-point status display when the activity timer is initialized by the host and set-point source is local, or when coil #8 is True and the computer set-point mode is Local. Default is LOC.
MNEMONIC	XXX	Where X = any of the characters listed in Step 8.5. Mnemonic appears in the set-point status display when the activity timer is initialized by the host and set-point source is Local 2. Default is LO2.
MNEMONIC	XXX	Where X = any of the characters listed in Step 8.5. Mnemonic appears in the set-point status display when the activity timer is initialized by the host and set-point source is Local 3. Default is LO3.

RS-485 COMMUNICATIONS SETUP

Table 1. RS-485 Setup Menu

Step	Step Description	Top Display
8.8	Computer Set-point Mnemonic (Local 4) <i>UP</i> or <i>DN</i> set values and <i>SCRL</i> accesses characters as described in Step 8.5. Press <i>SCRL</i> after the third character to continue with Step 8.9.	CMP LO4
8.9	Computer Set-point Mnemonic (Remote) <i>UP</i> or <i>DN</i> set values and <i>SCRL</i> accesses characters as described in Step 8.5. Press <i>SCRL</i> after the third character to continue with Step 8.10.	CMP REM
8.10	Computer Set-point Mode Value. <i>UP</i> or <i>DN</i> sets value <i>SCRL</i> to advance to Step 8.11	COMPUTER
8.11	Use Computer Active Tag <i>UP</i> or <i>DN</i> selects yes or no. <i>SCRL</i> to advance to Step 8.11.1 from yes or Step 8.12 (Computer Failure Setup) from no.	USE CMP
8.11.1	Computer Active Tag <i>UP</i> or <i>DN</i> sets value (press <i>UP</i> to begin then press <i>UP</i> to start at letter A or press <i>DN</i> to start at 9. Press <i>SCRL</i> to access the next character. Repeat through the last character. Press <i>SCRL</i> after the last character to advance to Step 8.12	COMPUTER
8.12	Computer Failure Setup. <i>UP</i> begins setup at step 8.12.1. <i>SCRL</i> to advance to Step 9 (bus enable).	CMP FAIL

RS-485 COMMUNICATIONS SETUP

Table 1. RS-485 Setup Menu

Middle Display	Bottom Display	Entry Description
MNEMONIC	XXX	Where X = any of the characters listed in Step 8.5. Mnemonic appears in the set-point status display when the activity timer is initialized by the host and set-point source is Local 4. Default is LO4.
MNEMONIC	XXX	Where X = any of the characters listed in Step 8.5. Mnemonic appears in the set-point status display when the activity timer is initialized by the host and set-point source is remote. Default is REM.
SPMD VAL	XXX	Where X = any value between 5 and 255. This value is OR'd into bits 13-6 of the the set-point mode register (#15) when the activity timer is enabled. Default value is 1.
ACT TAG	YES	= Display the computer active tag configured in Step 8.11.1 instead of the Tag Name configured in the Tune Menu when the activity timer is initialized by the host, This display appears in the top location in the Displays Menu.
	NO	=Don't display computer active tag.
ACT TAG	XXXXXXXX	Where X = any of the characters listed in Step 8.5. This is the tag name displayed when Step 8.11 is set at yes. Default tag is COMPUTER.
SETUP		This menu provides setup for the control mode, output values, set-point value and relays status following a computer failure. A failure is defined as a loss of communications from teh computer for a time greater than the timeout period configured in step 8.1.

RS-485 COMMUNICATIONS SETUP*Table 1. RS-485 Setup Menu*

Step	Step Description	Top Display
8.12.1	<p>Computer Fail Control Mode. <i>UP</i> or <i>DN</i> sets desired mode. <i>SCRL</i> to advance to Step 8.12.2 from AUTO if output 2 is available Step 8.12.3 from AUTO if Relay A is available Step 8.12.4 from AUTO if Relay B is available Step 8.12.5 from AUTO if Relay C is available or to Step 8.12.1.1 otherwise.</p>	CMP FAIL
8.12.1.1	<p>Computer Fail Output. <i>UP</i> or <i>DN</i> sets control output value. <i>SCRL</i> to advance to Step 8.12.1.1.1 (Computer Failed Output Value) from "NEW VALU" or to any step between 8.12.2 and 8.12.5 for outputs enabled as manual or computer only. If no outputs are assigned to manual or computer only, continue with Step 8.12.6 (Computer Fail Set-point Mode).</p>	CMP FAIL
8.12.1.1.1	<p>Computer Fail Output Value. <i>UP</i> or <i>DN</i> sets output value. <i>SCRL</i> to advance to any step between 8.12.2 and 8.12.5 for outputs enabled as manual or computer only. If no outputs are assigned to manual or computer only, continue with Step 8.12.6 (Computer Fail Set-point Mode).</p>	CMP FAIL
8.12.2	<p>Computer Fail Output 2. <i>UP</i> or <i>DN</i> sets value <i>SCRL</i> to advance to Step 8.12.2.1 (Computer Fail Output 2 Value) from "NEW VALU" or to any step between 8.12.3 and 8.12.5 for outputs enabled as manual or computer only. If no additional outputs are assigned to manual or computer only, continue with Step 8.12.6 (Computer Fail Set-point Mode).</p>	CMP FAIL

RS-485 COMMUNICATIONS SETUP

Table 1. RS-485 Setup Menu

Middle Display	Bottom Display	Entry Description
CTL MODE	LAST	=controller maintains the same control mode after a communications failure has been detected.
	MANUAL	=controller operates in manual following a computer failure with the output as defined in Step 8.12.1.1.
	AUTO	=controller operates in automatic following a computer failure with the set-point as defined in Step 8.12.6.1.1.
OUTPUT	LAST	=control output holds at the output value prior to the computer failure.
	NEW VALU	=control output set to value set in Step 8.12.1.1.1. Note: This new value is used only if the controller mode in Step 8.12.1 is manual (MAN) and a computer failure is detected.
OUT VAL	XXX	Where X = any value between 0 and 100%. This is the output of the controller if a computer failure is detected and the controller is in manual.
OUTPUT 2	LAST	=output 2 holds at the same value prior to the computer failure.
	NEW VALU	=output set to value set in Step 8.12.2.1. Note: This new value is used only if the retransmission variable in the "MA OUTP MENU" has been selected as manual or computer only, and if a computer failure is detected (see Table 4 in IB-23C650 for more information).

RS-485 COMMUNICATIONS SETUP*Table 1. RS-485 Setup Menu*

Step	Step Description	Top Display
8.12.2.1	Computer Fail Output 2 Value. <i>UP</i> or <i>DN</i> sets output 2 value. <i>SCRL</i> to advance to any step between 8.12.3 and 8.12.5 for additional outputs enabled as manual or computer only. If no outputs are assigned to manual or computer only, continue with Step 8.12.6 (Computer Fail Set-point Mode).	CMP FAIL
8.12.3	Computer Fail Relay A. <i>UP</i> or <i>DN</i> sets relay condition. <i>SCRL</i> to advance to Step 8.12.4 for relay B or Step 8.12.5 for relay C if they have been selected for manual or computer only or to Step 8.12.6 (Computer Fail Set-point Mode) if relays B or C have not been selected.	CMP FAIL
8.12.4	Computer Fail Relay B. <i>UP</i> or <i>DN</i> sets relay condition. <i>SCRL</i> to advance to step 8.12.5 for relay C if it has been selected for manual or computer only or to Step 8.12.6 (Computer Fail Set-point Mode) if it has not been selected.	CMP FAIL
8.12.5	Computer Fail Relay C. <i>UP</i> or <i>DN</i> sets relay condition. <i>SCRL</i> to advance to Step 8.12.6 (Computer Fail Set-point Mode).	CMP FAIL
8.12.6	Computer Fail Set-point Mode. <i>UP</i> or <i>DN</i> sets the set-point mode. <i>SCRL</i> to advance to Step 9 (Bus Enable) from LAST, REMOTE, or a local set-point configured as fixed in the set-points menu, or to Step 8.12.6.1 (Computer Fail Set-point) otherwise.	CMP FAIL

RS-485 COMMUNICATIONS SETUP

Table 1. RS-485 Setup Menu

Middle Display	Bottom Display	Entry Description
OUT2 VAL	XXX	Where X = any value between 0 and 100%. This is the output 2 value the controller will have if the retransmission variable in the "MA OUTP MENU" has been selected as manual or computer only and a computer failure has been detected.
RELAY A	LAST OFF ON	=relay state remains as it was prior to the detection of a computer fail. =relay goes to off state after a computer fail. =relay goes to on state after a computer fail.
RELAY B	LAST OFF ON	=relay state remains as it was prior to the detection of a computer fail. =relay goes to off state after a computer fail. =relay goes to on state after a computer fail.
RELAY C	LAST OFF ON	=relay state remains as it was prior to the detection of a computer fail. =relay goes to off state after a computer fail. =relay goes to on state after a computer fail.
SPT MODE	LAST LOCAL LOCAL-2 LOCAL-3 LOCAL-4 REMOTE	= controller uses the same set-point source after a computer fail has been detected. =Selecting any other set-point source causes the controller to use the selected set-point after a computer fail has been detected. Note: The local set-points need not be enabled in the "SETPTS MENU" for this use. If ramp/soak is running at the time of a computer fail, and a mode other than LAST has been selected, ramp/soak will discontinue.

RS-485 COMMUNICATIONS SETUP*Table 1. RS-485 Setup Menu*

Step	Step Description	Top Display
8.12.6.1	Computer Fail Set-point <i>UP</i> or <i>DN</i> sets the set-point value. <i>SCRL</i> to advance to step 9 (Bus Enable) from LAST or Step 8.12.6.1.1 (Computer Fail Set-point Value) from NEW VALU.	CMP FAIL
8.12.6.1.1	Computer Fail Set-point Value. <i>UP</i> or <i>DN</i> sets the set-point value. <i>SCRL</i> to advance to Step 9 (Bus Enable)	CMP FAIL
9	Bus Enable. <i>UP</i> or <i>DN</i> selects ON or OFF. <i>SCRL</i> to advance to Step 1	BUS

RS-485 COMMUNICATIONS SETUP

Table 1. RS-485 Setup Menu

Middle Display	Bottom Display	Entry Description
SETPOINT	LAST NEW VALU	<p>If any of the LOCAL set-point sources were selected in the previous step, "LAST" will cause the controller to use the current set-point value in that location. Selecting "NEW VALU" allows a new value (defined in Step 8.12.6.1.1) to be written into the set-point source register. Note: The set-point value entered into that set-point source in the "SETPTS MENU" will be overwritten by the new value.</p> <p>Ex.; LOC3 is selected as the computer fail set-point mode (step 8.4.6) and has been set at 58.3 in the "SETPTS MENU". The computer fail set-point value (set in Step 8.12.6.1.1) is set at 38.6. When a computer fail is detected, 38.6 will be written into LOC3.</p>
SPT VALU	XXXX	<p>Where X = -3000 to 30000. This value is limited by the specific set-point limits.</p>
ENABLE	ON OFF	<p>= enables the bus for communications with a host device.</p> <p>= disables the communications bus from receiving or writing with a host device.</p> <p>This duplicate entry is provided for convenience since the bus must be re-enabled following any parameter change.</p> <p>NOTE: IF this attribute setting is changed from OFF to ON, communication with the host device must be initiated by switching from LOCKED to REQUESTED at the computer (CMP) prompt in the DISPLAYS MENU. See Basic Operation With a Host Device for more information.</p>

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BASIC OPERATION WITH A HOST DEVICE

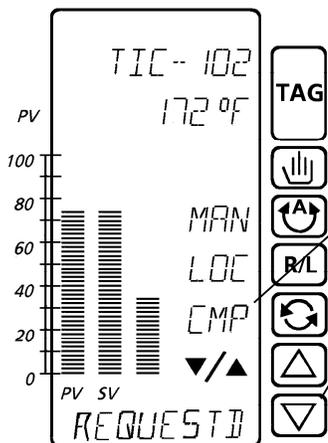
BASIC OPERATION WITH A HOST DEVICE

This section supplements the **Basic Operation Section** in **IB-23C650**. It covers the operational activities related to Modbus communication which are performed in the DISPLAYS MENU.

Enabling Write Communication With a Host

After completing the RS-485 communications setup, the host can read instrument data when the bus is enabled (see Table 1, Step 9). If write communication is required and the communication mode is LOCKED, the write function can be enabled as follows:

1. Go to the DISPLAYS MENU.



2. Press scroll. This allows the computer activity status to be displayed in the DISPLAYS MENU.
3. Press scroll until CMP appears in the bottom status display location.
4. Press *DN* or *UP* key to initiate communication with the host. When the key is pressed, the engineering display reads REQUESTD for a few seconds, then changes to ENABLED.

Standard Communication With a Host

In the standard communications mode the instrument functions as a stand alone controller which can receive read and write commands from the host. In this mode the last attribute entry becomes the active entry. For example, if the operator sets an active set-point value via the instrument display, and moments later the host sends a new set-point value, the controller uses the operators value until it receives the host value. At that time the host value becomes the new active set-point.

BASIC OPERATION WITH A HOST DEVICE

If necessary, the operator can disable the host from writing to the controller. This gives the operator total control of the instrument operation. The host can still read data from the instrument but cannot write to it.

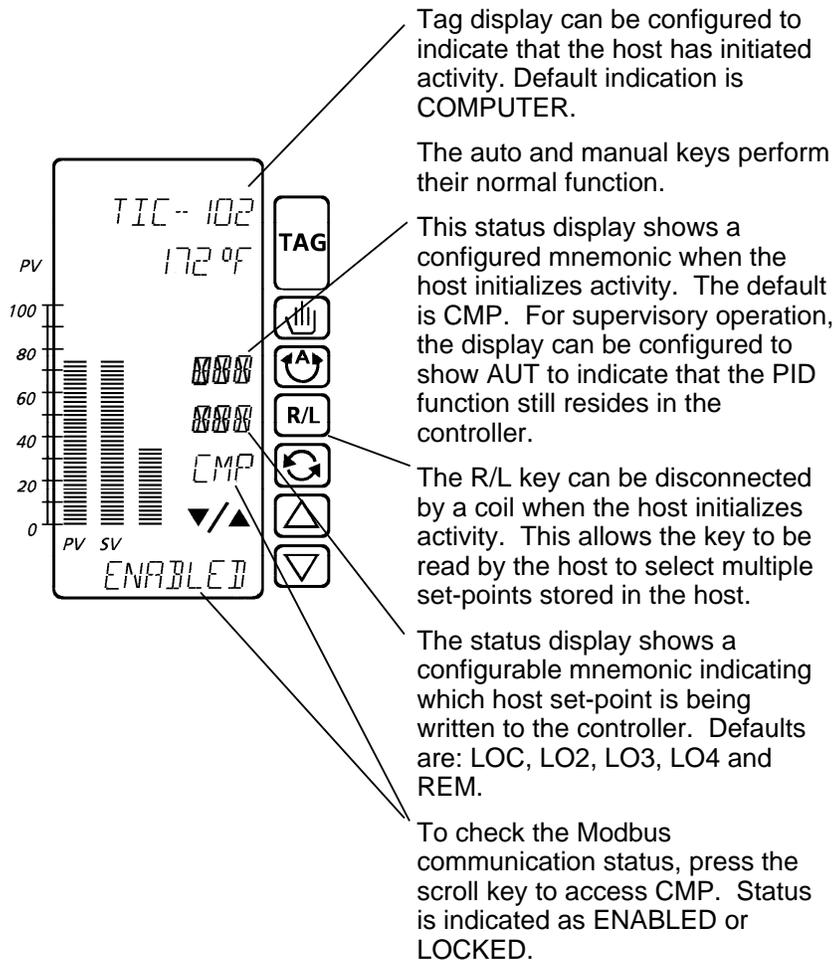
To disable the host, access the CMP status display as described in the previous section. When CMP appears, press the *DN* or *UP* key to change the status from ENABLED to LOCKED.

BASIC OPERATION WITH A HOST DEVICE

Supervisory Station

When the controller and host device are configured to provide a supervisory function, the controller receives its set-point from the host device. The controller executes its PID algorithm in the normal manner, and in general functions the same as a standard controller. This activity is initiated by the host.

The displays and control key operation for a supervisory station are as follows:

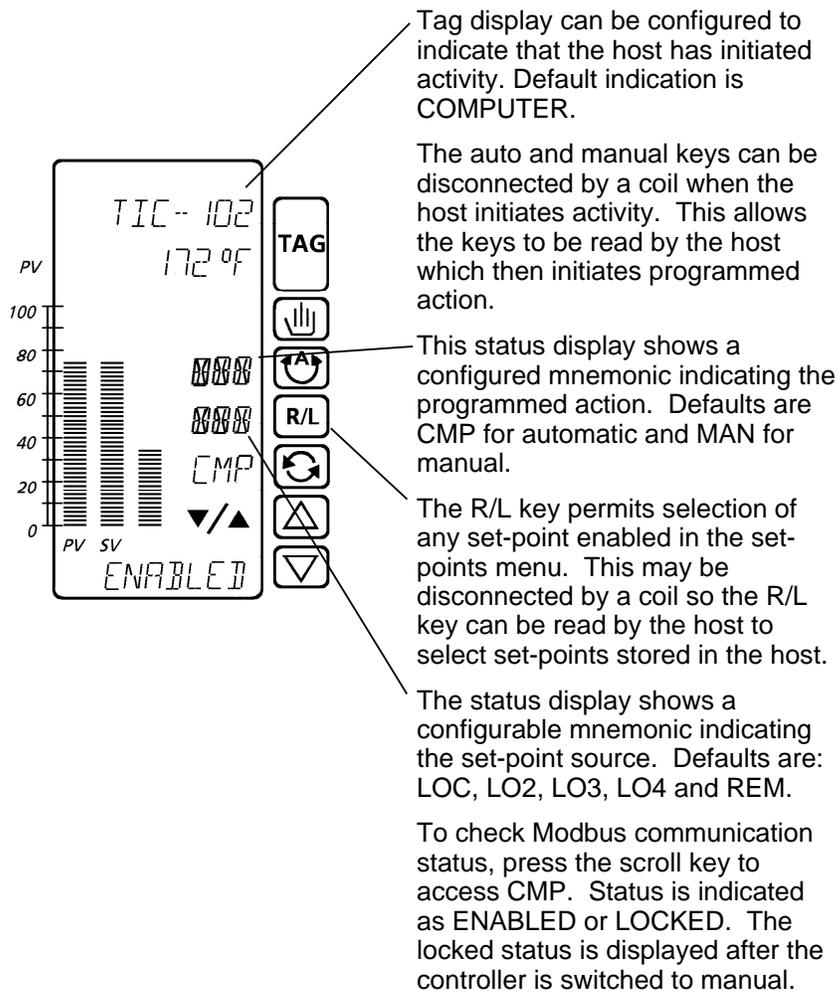


BASIC OPERATION WITH A HOST DEVICE

Computer Auto/Manual Station

When the controller and host device are configured to provide a computer auto/manual function, the host performs the PID control function. The results are communicated to the instrument and then to the field. This activity is initiated by the host.

The displays and control key operation for a computer auto/manual station are as follows:



BASIC OPERATION WITH A HOST DEVICE

Diagnostic Messages

The controller provides diagnostic messages which alert the user to communication problems. The Diagnostic messages are displayed on the TAG line. When one or more unacknowledged messages exist, the red LED on the ALARM key flashes, the message alternates with the TAG on the top display, and the beeper sounds if configured to do so. This activity continues until all diagnostic conditions are either acknowledged or no longer active. When only acknowledged diagnostic messages exist, the red LED is steady and the tag display shows only the tag.

Press the alarm key to view messages and acknowledge any unacknowledged conditions using the UP key.

Communication problems are indicated by the following diagnostic messages:

- [CMP INHB]
RS-485 bus write messages have been locked out by the operator.
- [CMP ERR]
One or more framing, parity, crc, etc. errors has occurred on RS-485 bus.
- [OVERCFGD]
Instrument is unable to complete all configured tasks in less than 250 msec. (operation will continue, but time based activities will be in error).

MODBUS PROTOCOL**MODBUS PROTOCOL****Communications Speed**

The controller supports baud rates of 150, 300, 1200, 2400, 4800, 9600, 19.2K, and 38.4K baud. Messages are not buffered. A new message (including broadcast type) will not be accepted until an existing message has been processed and responded to if necessary.

Message Response Time

The controller typically takes between 10 and 30 milliseconds to respond to a message requesting 10 registers. This time is from the end of the request message to the start of the response message.

The total amount of time a message takes to get back and forth between the host and the slave depends on the message size, baud rate and the slave's time to process the message. The following information is for a request message to read 10 registers:

- request message size is 8 characters + 3.5 idle time characters (11.5).
- response message size is 25 characters + 3.5 idle time characters (28.5).
- for this example, a character is 11 bits (1 start, 8 data, 1 parity, 1 stop).
- Therefore, the total typical time using a controller response time of 30 milliseconds is shown below for the various baud rates:

Baud Rate	Request Time (mSec)	Response Time (mSec)	Total Typical Time (mSec)
150	623	2090	2743
300	312	1045	1387
1200	78	261	369
2400	39	131	190
4800	19	65	114
9600	10	33	73
19200	5	16	51
38400	2	8	40

MODBUS PROTOCOL

Messages Supported

The controller utilizes registers and coils to access information. The following MODBUS messages are supported by the controller. See the Gould MODBUS Protocol Reference Guide dated Jan. 1985 for further detail.

Note: In cases where the controller processor is already heavily loaded, it may be necessary to limit the number of registers or coils addressed by any single message. Limiting the number of coils and registers in a single message will avoid pushing the instrument into the "over configured" condition (>250 milliseconds scan time). Only repetitive messages are a concern in this regard.

MODBUS PROTOCOLTable 2. *MODBUS messages supported by the 2050R Controller*

MODBUS Function Code	MODBUS Message Name	2050R Definition
01	Read Coil Status	Read "n" consecutive discrete (boolean) points from a specified starting point. The controller returns zeros for points which do not contain defined data and will nak any request for point numbers greater than 9999. See Note, page 34.
02	Read Input Status	Same as Read Coil Status.
03	Read Holding Registers	Read "n" consecutive registers from specified starting register. The controller returns zeros for registers which do not contain defined data and will nak any request for register numbers greater than 9999. See Note, page 34.
04	Read Input Registers	Same as Read Holding Registers
05	Force Single Coil	Write one discrete (boolean) point. The controller will nak this if the point is not currently writeable.
06	Preset Single Register	Write one register. The controller will nak this if the register is not currently writeable. It will also apply any currently applicable limits to the value before storage in the database.
08	Loopback Diagnostic Test	Echo the message. Only "Return of Query" is supported.
15	Force Multiple Coils	Write "n" consecutive coils from a specified starting coil. The controller will nak if any of the coils are not currently writeable, but will still do all the writes which are valid. See Note, page 34.
16	Preset Multiple Registers	Write "n" consecutive registers from a specified starting register. The controller will nak if any of the registers are not currently writeable, but will still do all the writes which are valid, applying any currently applicable limits to the values before storage in the database. See Note, page 34.

MODBUS PROTOCOL**Message Formats**

The following message formats are used to transfer information between the controller and a host. Refer to the message format example for format details.

Read Coil Status, Read Input Status

Master Message Format Bytes

0	1	2 & 3	4 & 5	6 & 7
Device Address	Function Code	Starting Coil Number	Number of Coils	CRC

Slave Response Bytes

0	1	2	3	...	x	x+1 & x+2
Device Address	Function Code	Number of Data Bytes	Data byte #1	...	Data Byte #n	CRC

Read Holding Registers, Read Input Registers

Master Message Format Bytes

0	1	2 & 3	4 & 5	6 & 7
Device Address	Function Code	Starting Register Number	Number of Registers	CRC

Slave Response Bytes

0	1	2	3 & 4	...	x & x+1	x+2 & x+3
Device Address	Function Code	Number of Data Bytes	Register #1 data	...	Register #n data	CRC

Force Single Coil

Master Message Format Bytes

0	1	2 & 3	4 & 5	6 & 7
Device Address	Function Code	Coil Number	Coil Data ON = FF00 OFF = 0000	CRC

Slave Response (simple echo) Bytes

0	1	2 & 3	4 & 5	6 & 7
Device Address	Function Code	Coil Number	Coil Data ON = FF00 OFF = 0000	CRC

MODBUS PROTOCOL

Preset Single Register

Master Message Format Bytes

0	1	2 & 3	4 & 5	6 & 7
Device Address	Function Code	Register Number	Register Data	CRC

Slave Response (simple echo) Bytes

0	1	2 & 3	4 & 5	6 & 7
Device Address	Function Code	Register Number	Register Data	CRC

Loopback Diagnostic Test

Master Message Format Bytes

0	1	2 & 3	4 & 5	6 & 7
Device Address	Function Code	Diagnostic Code (0000 only)	Data (ignored)	CRC

Slave Response (simple echo) Bytes

0	1	2 & 3	4 & 5	6 & 7
Device Address	Function Code	Diagnostic Code (0000 only)	Data (ignored)	CRC

Force Multiple Coils

Master Message Format Bytes

0	1	2 & 3	4 & 5	6	7	...	x	x+1 & x+2
Device Address	Function Code	Starting Coil Number	Number of Coils	Number of Data Bytes	Data Byte 1	...	Data Byte n	CRC

Slave Response Bytes

0	1	2 & 3	4 & 5	6 & 7
Device Address	Function Code	Starting Coil Number	Number of Coils	CRC

MODBUS PROTOCOL**Preset Multiple Registers**

Master Message Format Bytes

0	1	2 & 3	4 & 5	6	7 & 8	...	x & x+1	x +2 & x+3
Device Address	Function Code	Starting Register Number	Number of Registers	Number of Data Bytes	Register Data 1	...	Register Data n	CRC

Slave Response Bytes

0	1	2 & 3	4 & 5	6 & 7
Device Address	Function Code	Starting Register Number	Number of Registers	CRC

Coil Data Example

Coil data is packed 1 bit per coil. The low order bit of the first data byte contains the addressed coil and unused bits are zero filled. For instance, if coils 22 through 33 are requested, two data bytes will be returned with the coil data located as follows; (coils 22,24,25,26,29,30,32 and 33 are on).

	coil # 29		26	25	24		22						33	32		30	
data bytes 1 & 2	1	0	0	1	1	1	0	1		0	0	0	0	1	1	0	1

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

The tables in this section provide a listing of the controller's numeric attributes which are addressed as registers. The tables divide the attributes into related groups such as tuning, alarms, etc. A group of numeric attributes may have associated boolean (discrete) attributes which are addressed as coils. The boolean attributes are listed in the next section.

The following tables list the attributes in order by Modbus register number. The letters below each number indicate whether the attribute is readable and writeable or read only:

- R W Readable and Writeable
- R _ Read only

Common Data (registers)

Reg. #	Description	Register Value	2050R Displayed Value
4 R W	Maximum milliseconds used in any one cycle. This value is updated by the controller and can be reset to zero with a write by the host.	Typically written from host as 0.	not displayed
5 R _	Average milliseconds used per cycle. This should not exceed 250 milliseconds.	Number of milliseconds	not displayed
6 R _	Bits 15 - 4 indicate unacknowledged process alarms (PA) and diagnostics (DIAG). Bit 15 = PA1 Bit 14 = PA2 Bit 13 = PA3 Bit 12 = PA4 Bit 11 = DIAG1 Bit 10 = DIAG2 Bit 9 = DIAG3 Bit 8 = DIAG4 Bit 7 = DIAG5 Bit 6 = DIAG6 Bit 6 = DIAG7 Bit 6 = DIAG8 Bits 0-3 Not Used Refer to coil numbers 41-48 for alarms and 49-64 for diagnostics.		

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

Common Data (registers) Cont'd

Reg. #	Description	Register Value	2050R Displayed Value
7 R _	Field Input 1 Register #9, Bits 1 & 0 = 0 Register #9, Bits 1 & 0 = 1 Register #9, Bits 1 & 0 = 2 Register #9, Bits 1 & 0 = 3 Note: This register permits reading of actual process input to 2050R when Coil #14 is TRUE. Data is copied to Reg. #10 when Coil #14 is FALSE.	-32000 to +32000 -32000 to +32000 -32000 to +32000 -32000 to +32000	-32000 to +32000 -3200.0 to +3200.0 -320.00 to +320.00 -32.000 to +32.000 Values are not displayed when Coil #14 is TRUE. See Reg. #10
8 R _	Field Input 2 Note: This register permits reading of actual input 2 to 2050R when Coil #15 is TRUE. Data is copied to Reg. #11 when Coil #15 is FALSE.	Same as Reg. #7	Same as Reg. #7 values Values are not displayed when Coil #15 is TRUE. See Reg. #11.
9 Bits 15 - 4 R _	Bits 15 - 4 indicate active process alarms (PA) and diagnostics (DIAG). See Register #6 for bit descriptions.		
Bits 1 & 0 R _	Process decimal point. Positions the decimal point in the process and set-points engineering displays.	0 1 2 3	n n.n n.nn n.nnn
10 R W	Process Variable for Display • Coil #14 is FALSE: Actual 2050R Process variable (field input 1) is displayed • Coil #14 is TRUE: Display value is written from host	Same as Reg. #7 values Same as Reg. #7 values	Same as Reg. #7 values Same as Reg. #7 values
11 R W	Active set-point variable Register No. 9, Bits 1 & 0 = 0 Register No. 9, Bits 1 & 0 = 1 Register No. 9, Bits 1 & 0 = 2 Register No. 9, Bits 1 & 0 = 3	-3000 to 30000 -3000 to 30000 -3000 to 30000 -3000 to 30000	-3000 to 30000 -300.0 to 3000.0 -30.00 to 300.00 -3.000 to 30.000
12 R W	Control analog output value.	-80 to 1100	-8.0 to 110.0
13 R W	Input No. 2 • Coil # 15 is FALSE: Input No. 2 value is obtained from Field Input 2 • Coil #15 is TRUE: Input No. 2 value is written from host	Same as Reg. #7 values Same as Reg. #7 values	Same as Reg. #7 values Same as Reg. #7 values

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

Common Data (registers) Cont'd

Reg. #	Description	Register Value	2050R Displayed Value
14 Bits 9 - 2 R W	Computer active control mode value (this is a copy of register #77). This part present only when activity timer is enabled.	0 to 255	Not Displayed See RS-485 Setup; Table 1, Step 8.4.
Bit 10 R W	Output Tracking	1 0	TRK
Bit 1 R W	Computer Auto/Manual status. When Coil #10 is TRUE, the A and M keys change this status instead of the controller mode. This part present only when activity timer is enabled.	1 0	AUT MAN Displayed Mnemonic is configurable, defaults are shown. See Reg. #75, 76, 113 & 114
Bit 0 R W	Control mode of 2050R	1 0	AUT MAN
15 Bits 13 - 6 R W	Computer (host) Set-point mode value This part present only when activity timer is enabled.	5 to 255	Not Displayed See RS-485 Setup; Table 1, Step 8.10.
Bits 5 - 0 R W	Computer Remote/Local status. When Coil #8 is TRUE, the R/L key changes this status instead of the set-point status. This part present only when activity timer is enabled.	0 1 2 3 4 • • • to value in register #123	LOC LO2 LO3 LO4 REM Displayed Mnemonic is configurable for values 0-5, defaults are shown. See Reg #78 & #115 thru #122
Bits 2 - 0 R W	2050R Set-point source	0 1 2 3 4	LOC LO2 LO3 LO4 REM
16 R W	Analog output #2 value	-100 to 1100	-10.0 to 110.0
17 R W	Local set-point 1 value	Same as Reg.#11	Same as Reg.#11
18 R W	Local set-point 2 value	Same as Reg.#11	Same as Reg.#11
19 R W	Local set-point 3 value	Same as Reg.#11	Same as Reg.#11
20 R W	Local set-point 4 value	Same as Reg.#11	Same as Reg.#11

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

Ramp/Soak Profile and Totalizer Data (registers)

Reg. #	Description	Register Value	2050R Displayed Value
30 R _	Ramp/soak segment time remaining. Time remaining in the currently active ramp/soak segment.	0 to 32000	0.0 to 3200
31 R _	Current ramp/soak cycle.	0 to 65535	0 to 65535
32 R _	Current ramp/soak segment	1 to 10	1 to 10
33 R _	Floating point totalized count hi bytes. Upper 2 bytes of totalized count in IEEE floating point format. Register #9, bits 1 & 0 = 0 Register #9, bits 1 & 0 = 1 Register #9, bits 1 & 0 = 2 Register #9, bits 1 & 0 = 3	IEEE Single precision floating point value Same as above Same as above Same as above	0000000 to 9999999 000000.0 to 999999.9 00000.00 to 99999.99 0000.000 to 9999.999
34 R _	Floating point totalized count low bytes. Lower 2 bytes of totalized count in IEEE floating point format.	Same as Reg #33	Same as Reg #33
35 R _	Integer totalized count. Permits transfer of totalized count in integer format. Tops out at 65K Register # 9, Bits 1&0 = 0 Register # 9, Bits 1&0 = 1 Register # 9, Bits 1&0 = 2 Register # 9, Bits 1&0 = 3	0 to 65535 0 to 65535 0 to 65535 0 to 65535	0 to 65535 0 to 6553.5 0 to 655.35 0 to 65.535
36 R W	Floating point totalizer preset hi bytes. Upper 2 bytes of totalizer preset number in IEEE floating point format.	Same as Reg #33	Same as Reg #33
37 R W	Floating point totalizer preset low bytes. Lower 2 bytes of totalizer preset number in IEEE floating point format.	Same as Reg #33	Same as Reg #33
38 R W	Integer totalizer preset count. Permits transfer of totalizer preset number in integer format.	Same as Reg #35	Same as Reg #35

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

Ramp/Soak Profile and Totalizer Data (registers) Cont'd

Reg. #	Description	Register Value	2050R Displayed Value
39 R W	Floating point totalizer predetermined count hi bytes. Upper 2 bytes of totalizer predetermined count in IEEE floating point format.	Same as Reg #33	Same as Reg #33
40 R W	Floating point totalizer predetermined count low bytes. Lower 2 bytes of predetermined count in IEEE floating point format	Same as Reg #33	Same as Reg #33
41 R W	Integer totalizer predetermined count. Permits transfer of totalizer predetermined count in integer format.	Same as Reg #35	Same as Reg #35
42 R _	Totalizer scale decimal point. Sets the decimal point position in the totalizer scale factor (Reg. # 43).	0 1 2 3	0 0.0 0.00 0.000
43 R W	Totalizer scale factor. Permits fractional scaling of an input signal. Register No. 42 =0 Register No. 42 =1 Register No. 42 =2 Register No. 42 =3	1 to 30000 1 to 30000 1 to 30000 1 to 30000	1 to 30000 0.1 to 3000.0 0.01 to 300.00 0.001 to 30.000

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

Tuning Parameter Data (registers)

Reg. #	Description	Register Value	2050R Displayed Value
50 R W	Autotune output step size	1 TO 500	0.1 to 50.0
51 R W	Autotune hysteresis value Register No. 9 = 0 Register No. 9 = 1 Register No. 9 = 2 Register No. 9 = 3	1 to 30000 1 to 30000 1 to 30000 1 to 30000	0.1 to 3000.0 0.01 to 300.00 0.001 to 30.000 0.001 to 30.000
52 R W	Autotune process variable maximum (high trip point) Register #9, bits 1 & 0 = 0 Register #9, bits 1 & 0 = 1 Register #9, bits 1 & 0 = 2 Register #9, bits 1 & 0 = 3	-29970 or Reg. #53 value +30 to 300000. Same as above Same as above Same as above	-2997 or Low Trip Point +3 to 30000. -299.7 or Low Trip Point +0.3 to 3000.0 -29.97 or Low Trip Point +0.03 to 300.00 -2.997 or Low Trip Point +0.003 to 30.000
53 R W	Autotune process variable minimum (low trip point) Register #9, bits 1 & 0 = 0 Register #9, bits 1 & 0 = 1 Register #9, bits 1 & 0 = 2 Register #9, bits 1 & 0 = 3	-30000 to 299970 or Reg. #52 value - 30 Same as above Same as above Same as above	-3000 to 29997 or High Trip Point - 3. -300.0 to 2999.7 or High Trip Point - 0.3. -30.00 to 299.97 or High Trip Point - 0.03. -3.000 to 29.997 or High Trip Point - 0.003.
54 R_	Autotune error number	0 2 3 5 6	No error Increase step Process slow Decrease step Response limited

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

Tuning Parameter Data (registers) Cont'd

Reg. #	Description	Register Value	2050R Displayed Value
55 R W	Gain or heat gain value	1 to 30000	0.1 to 3000.0
56 R W	Reset or heat reset	10 to 12000	0.01 to 120.00 repeats/minute
57 R W	Preact value	0 to 30000	0.0 to 3000.0 seconds derivative response
58 R W	Manual reset value	0 to 1000	0.0 to 100.0%
59 R W	Remote set-point ratio or AMRB ratio	-30000 to 30000	-300.00to 300.00
60 R W	Remote set-point bias or AMRB bias Register #9, bits 1 & 0 = 0 Register #9, bits 1 & 0 = 1 Register #9, bits 1 & 0 = 2 Register #9, bits 1 & 0 = 3	-30000 to 300000 -30000 to 300000 -30000 to 300000 -30000 to 300000	-3000 to 30000 -300.0 to 3000.0 -30.00 to 300.00 -3.000 to 30.000
61 R W	Time proportioning cycle time or heat cycle time	10 to 3000	1.0 to 300.0 sec.
62 R W	On/off differential gap Register #9, bits 1 & 0 = 0 Register #9, bits 1 & 0 = 1 Register #9, bits 1 & 0 = 2 Register #9, bits 1 & 0 = 3	0 to 1000 0 to 1000 0 to 1000 0 to 1000	0 to 100 0.0 to 10.0 0.00 to 1.00 0.000 to 0.100
63 R W	Heat/cool output crossover	1 to 3000	0.1 to 300.0%
64 R W	Crossover output off hysteresis	0 to 250	0.0 to 25.0 in % output centered on crossover value (±25%)
65 R W	Cool gain value	1 to 30000	0.1 to 3000.0
66 R W	Cool reset value	10 to 1200	0.1 to 120.0 repeats/minute
67 R W	Cool cycle time value	10 to 3000	1.0 to 300.0 sec.
68 R W	Position proportioning deadband value	0 to 500	0.0 to 50.0%
69 R W	Position proportioning preact value	0 to 500	0.0 to 50.0%

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

Alarm Data (registers)

Reg. #	Description	Register Value	2050R Displayed Value
70 R W	Alarm 1 trip point <ul style="list-style-type: none"> • Process High or Low <ul style="list-style-type: none"> Register #9, bits 1 & 0 = 0 Register #9, bits 1 & 0 = 1 Register #9, bits 1 & 0 = 2 Register #9, bits 1 & 0 = 3 • Deviation High or Low <ul style="list-style-type: none"> Register #9, bits 1 & 0 = 0 Register #9, bits 1 & 0 = 1 Register #9, bits 1 & 0 = 2 Register #9, bits 1 & 0 = 3 • Output High or Low • Input 2 High or low 	<ul style="list-style-type: none"> -2995 to 30000 -2995 to 30000 -2995 to 30000 -2995 to 30000 1 to 30000 1 to 30000 1 to 30000 1 to 30000 0 to 1000 Same as Process high or low 	<ul style="list-style-type: none"> -2995 to 30000 -299.5 to 3000.0 -29.95 to 300.00 -2.995 to 30.000 1 to 30000 0.1 to 3000.0 0.01 to 300.00 0.001 to 30.000 0.0 to 100.0 Same as Process high or low
71 R W	Alarm 2 trip point	Same as Reg. # 70	Same as Reg. #70
72 R W	Alarm 3 trip point	Same as Reg. # 70	Same as Reg. #70
73 R W	Alarm 4 trip point	Same as Reg. # 70	Same as Reg. #70

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

Computer Activity Data (registers)

Reg. #	Description	Register Value	2050R Displayed Value
74 R W	Computer active: timeout value	1 to 16383	1 to 16383 sec.
75 R W	Automatic control mode status display mnemonic with computer active. Default display is CMP. Each character is configurable; this register defines the first character (C in the default CMP).	ASCII code for first character in status display	Letter C (default) or letters A-Z, numbers 0-9 plus other special characters per configuration. See RS-485 Setup Menu.
76 R W	Same as display described in Reg. #75. This register defines the second and third characters (M and P in the default CMP).	ASCII code for second and third characters in status display	Letters M and P (default) or letters A-Z, numbers 0-9 plus other special characters per configuration. See RS-485 Setup Menu.
77 R W	Computer active: control mode value Default is 1.	0 to 255	0 to 255
78 R W	Local Set-point status display mnemonic with computer active. Default display is LOC. Each character is configurable; this register defines the first character (L in the default LOC).	Same as Reg. #75	Letter L (default) or letters A-Z, numbers 0-9 plus other special characters per configuration. See RS-485 Setup Menu
79 R W	Same as display described in Reg. #78. This register defines the second and third characters (O and C in the default LOC).	Same as Reg. #76	Letters O and C (default) or letters A-Z, numbers 0-9 plus other special characters per configuration. See RS-485 Setup Menu.

Note: The "computer active" references in this section mean "when the computer activity timer is enabled".

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

Computer Activity Data (registers) Cont'd

Reg. #	Description	Register Value	2050R Displayed Value
80 R W	Computer active: set-point mode value	0 to 255	0 to 255
81 R W	Computer fail: control mode	0 1 2	Last Manual Auto
82 R W	Computer fail: output value	0 to 1000	0.0 to 100.0%
83 R W	Computer fail: output 2 value	0 to 1000	0.0 to 100.0%
84 R W	Computer fail: relay A	0 1 2	Last Off On
85 R W	Computer fail, relay B	Same as Reg. #84	Same as Reg. #84
86 R W	Computer fail: relay C	Same as Reg. #84	Same as Reg. #84
87 R W	Computer fail: set-point mode	0 1 2 3 4 5	Last LOC LO2 LO3 LO4 REM
88 R W	Computer fail: set-point value Register #9, bits 1 & 0 = 0 Register #9, bits 1 & 0 = 1 Register #9, bits 1 & 0 = 2 Register #9, bits 1 & 0 = 3	-3000 to 30000 -3000 to 30000 -3000 to 30000 -3000 to 30000	-3000 to 30000 -300.0 to 3000.0 -30.00 to 3000.00 -3.000 to 30.000
	See register #113 through #131 for more computer activity data		

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

Ramp/Soak Profile Configuration Data (registers)

Reg. #	Description	Register Value	2050R Displayed Value
89 R W	Ramp/soak soak hysteresis Register #9, bits 1 & 0 = 0 Register #9, bits 1 & 0 = 1 Register #9, bits 1 & 0 = 2 Register #9, bits 1 & 0 = 3	1 to 30000 1 to 30000 1 to 30000 1 to 30000	1 to 30000 0.1 to 3000.0 0.01 to 300.00 0.001 to 30.000
90 R W	Ramp/soak ramp hysteresis	Same as Reg. #89	Same as Reg. #89
91 R W	Ramp/soak number of segments	0 to 10	0 to 10
92 R W	Ramp/soak segment 1 starting set-point Register #9, bits 1 & 0 = 0 Register #9, bits 1 & 0 = 1 Register #9, bits 1 & 0 = 2 Register #9, bits 1 & 0 = 3	-3000 to 30000 -3000 to 30000 -3000 to 30000 -3000 to 30000	-3000 to 30000 -300.0 to 3000.0 -30.00 to 300.00 -3.000 to 30.000
93 R W	Ramp/soak segment 1 ending set-point Register #9, bits 1 & 0 = 0 Register #9, bits 1 & 0 = 1 Register #9, bits 1 & 0 = 2 Register #9, bits 1 & 0 = 3	-3000 to 30000 -3000 to 30000 -3000 to 30000 -3000 to 30000	-3000 to 30000 -300.0 to 3000.0 -30.00 to 300.00 -3.000 to 30.000
94 R W	Ramp/soak segment 1 ramp-rate Register #9, bits 1 & 0 = 0 Register #9, bits 1 & 0 = 1 Register #9, bits 1 & 0 = 2 Register #9, bits 1 & 0 = 3 - OR - Ramp/soak segment 1 soak-time	1 to 30000 1 to 30000 1 to 30000 1 to 30000 0 to 30000	1 to 30000 0.1 to 3000.0 0.01 to 300.00 0.001 to 30.000 0.0 to 3000.0 Units are hours or minutes as defined in Time Units.
95 R W	Ramp/soak segment 2 ending set-point	Same as Reg. #93	Same as Reg. #93
96 R W	Ramp/soak segment 2 ramp-rate or soak-time	Same as Reg. #94	Same as Reg. #94
97 R W	Ramp/soak segment 3 ending set-point	Same as Reg. #93	Same as Reg. #93
98 R W	Ramp/soak segment 3 ramp-rate or soak-time	Same as Reg. #94	Same as Reg. #94

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA**Ramp/Soak Profile Configuration Data (registers) Cont'd**

Reg. #	Description	Register Value	2050R Displayed Value
99 R W	Ramp/soak segment 4 ending set-point	Same as Reg. #93	Same as Reg. #93
100 R W	Ramp/soak segment 4 ramp-rate or soak-time	Same as Reg. #94	Same as Reg. #94
101 R W	Ramp/soak segment 5 ending set-point	Same as Reg. #93	Same as Reg. #93
102 R W	Ramp/soak segment 5 ramp-rate or soak-time	Same as Reg. #94	Same as Reg. #94
103 R W	Ramp/soak segment 6 ending set-point	Same as Reg. #93	Same as Reg. #93
104 R W	Ramp/soak segment 6 ramp-rate or soak-time	Same as Reg. #94	Same as Reg. #94
105 R W	Ramp/soak segment 7 ending set-point	Same as Reg. #93	Same as Reg. #93
106 R W	Ramp/soak segment 7 ramp-rate or soak-time	Same as Reg. #94	Same as Reg. #94
107 R W	Ramp/soak segment 8 ending set-point	Same as Reg. #93	Same as Reg. #93
108 R W	Ramp/soak segment 8 ramp-rate or soak-time	Same as Reg. #94	Same as Reg. #94
109 R W	Ramp/soak segment 9 ending set-point	Same as Reg. #93	Same as Reg. #93
110 R W	Ramp/soak segment 9 ramp-rate or soak-time	Same as Reg. #94	Same as Reg. #94
111 R W	Ramp/soak segment 10 ending set-point	Same as Reg. #93	Same as Reg. #93
112 R W	Ramp/soak segment 10 ramp-rate or soak-time	Same as Reg. #94	Same as Reg. #94

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

More Computer Activity Data (registers)

Reg. #	Description	Register Value	2050R Displayed Value
113 R W	Manual control mode status display mnemonic with computer active. Default display is MAN. Each character is configurable; this register defines the first character (M in the default MAN).	ASCII code for first character in status display	Letter M (default) or letters A-Z, numbers 0-9 plus other special characters per configuration. See RS-485 Setup Menu.
114 R W	Same as display described in Reg. #113. This register defines the second and third characters (A and N in the default MAN).	ASCII code for second and third characters in status display	Letters A and N (default) or letters A-Z, numbers 0-9 plus other special characters per configuration. See RS-485 Setup Menu.
115 R W	Local 2 set-point status display mnemonic with computer active. Default display is LO2. Each character is configurable; this register defines the first character (L in the default LO2).	Same as Reg. #113	Letter L (default) or other configured character. See Reg. #113.
116 R W	Same as display described in Reg. #115. This register defines the second and third characters (O and 2 in the default LO2).	Same as Reg. #114	Letter O & #2 (default) or other configured characters. See Reg. #114.
117 R W	Local 3 set-point status display mnemonic with computer active. Default display is LO3. Each character is configurable; this register defines the first character (L in the default LO3).	Same as Reg. #113	Letter L (default) or other configured character. See Reg. #113.
118 R W	Same as display described in Reg. #117. This register defines the second and third characters (O and 3 in the default LO3)	Same as Reg. #114	Letter O & #3 (default) or other configured characters. See Reg. #114.

Note: The "computer active" references in this section mean "when the computer activity timer is enabled".

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA**More Computer Activity Data (registers) Cont'd**

Reg. #	Description	Register Value	2050R Displayed Value
119 R W	Local 4 set-point status display mnemonic with computer active. Default display is LO4. Each character is configurable; this register defines the first character (L in the default LO4).	Same as Reg. #113	Letter L (default) or other configured character. See Reg. #113.
120 R W	Same as display described in Reg. #119. This register defines the second and third characters (O and 4 in the default LO4)	Same as Reg. #114	Letter O & #4 (default) or other configured characters. See Reg. #114.
121 R W	Remote set-point status display mnemonic with computer active. Default display is REM. Each character is configurable; this register defines the first character (R in the default REM).	Same as Reg. #113	Letter R (default) or other configured character. See Reg. #113.
122 R W	Same as display described in Reg. #121. This register defines the second and third characters (E and M in the default REM)	Same as Reg. #114	Letters E and M (default) or other configured characters. See Reg. #114.
123 R W	Maximum computer Remote/Local status value (see register #15).	As Configured	Not applicable
124 R W	Loop Tag Display message with computer active. Default message is COMPUTER. This register defines the first and second characters (C and O in the default COMPUTER).	ASCII code for configured characters	Letters C and O (default) or other configured characters. See Reg. #114.
125 R W	Same as display described in Reg. #124. This register defines the third and fourth characters (M and P in the default COMPUTER)	Same as Reg #124	Letters M and P (default) or other configured characters. See Reg. #114.
126 R W	Same as display described in Reg. #124. This register defines the fifth and sixth characters (U and T in the default COMPUTER)	Same as Reg #124	Letters U and T (default) or other configured characters. See Reg. #114.

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

More Computer Activity Data (registers) Cont'd

Reg. #	Description	Register Value	2050R Displayed Value
127 R W	Same as display described in Reg. #124. This register defines the seventh and eighth characters (E and R in the default COMPUTER	Same as Reg #124	Letters E and R (default) or other configured characters. See Reg. #114.
128 R W	Loop Tag Display. This is the normal tag as configured in the TUNE Menu (see Table 12 in IB-23C650). This register defines the first and second characters of the tag name.	Same as Reg #124	First and second characters in tag name
129 R W	Same as display described in Reg. #128. This register defines the third and fourth characters of the tag name.	Same as Reg #124	Third and fourth characters in tag name
130 R W	Same as display described in Reg. #128. This register defines the fifth and sixth characters of the tag name.	Same as Reg #124	Fifth and sixth characters in tag name
131 R W	Same as display described in Reg. #128. This register defines the seventh and eighth characters of the tag name.	Same as Reg #124	Seventh and eighth characters in tag name

CONTROLLER ATTRIBUTE LISTING - REGISTER DATA

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CONTROLLER ATTRIBUTE LISTING - COIL DATA

CONTROLLER ATTRIBUTE LISTING - COIL DATA

The tables in this section provide a listing of the 2050R boolean (discrete) attributes which are addressed as coils. The description column **identifies the TRUE state of each attribute**. The binary values are:

- TRUE = 1
- FALSE = 0

The tables list the attributes in order by Modbus coil number. The letters below each number indicate whether the attribute is readable and writeable, read only or write only:

- R W Readable and Writeable
- R _ Read only
- _ W Write only (Write only applies to command type attributes. They can be read but the value returned is always 0.)

Computer Activity Data (coils)

Coil. #	Description	Reference Information
7 R W	Computer tag is displayed in Loop Tag Display (top) location when computer (host) is active.	See <i>Table 1, Step 11</i> in this supplement.
8 R W	Remote /Local key and digital inputs change computer R/L status, not 2050R set-point mode when computer is active.	
9 R W	Operator can manually change output when Coil #10 is TRUE, 2050R is in MANUAL and computer A/M status is Auto.	
10 R W	Auto and manual keys change computer A/M status, not 2050R control mode when computer is active.	
11 R W	Enable "computer fail" set-point value	See <i>Table 1, Step 8.12.6.1</i> in this supplement
12 R W	Enable "computer fail" output 2 value	See <i>Table 1, Step 8.12.2</i> in this supplement.
13 R W	Enable "computer fail" output value	See <i>Table 1, Step 8.12.1.1.1</i> in this supplement.

CONTROLLER ATTRIBUTE LISTING - COIL DATA

Computer Activity Data (coils) Cont'd

Coil #	Description	Reference Information
14 R W	Decouple field input 1 from process variable.	
15 R W	Decouple field input 2 from internal variable.	
16 R W	Computer active	Write to start computer activity timer; Read to see if timer is running (see Table 1, Step 8.1).
17 R W	Computer writes enabled	See Standard Communication With a Host in the Basic Operation With A Host Device Section of this supplement.

Digital Input and Output Data (coils)

Coil #	Description	Reference Information
18 R _	Digital input 1 on	This is the same as DI1 Enable/Disable in the Display Menu. See Enabling Digital Inputs in the Operation Using Digital Inputs Section of the IB-23C650 User's guide
19 R _	Digital input 2 on	Same as Coil #18 for DI2.
20 R W	Relay output A on	See <i>Table 5, Output Relays Setup Menu</i> in the IB-23C650 User's Guide .
21 R W	Relay output B on	Same as Coil #20
22 R W	Relay output C on	Same as Coil #20
23 R W	Enable digital input 1	Same as Coil #18
24 R W	Enable digital input 2	Same as Coil #18

CONTROLLER ATTRIBUTE LISTING - COIL DATA

Ramp/Soak Data (coils)

25 R W	Ramp/soak RUN	See Ramp/Soak Operation in the IB-23C650 User's Guide .
26 _ W	Ramp/soak RESET	Same as Coil #25
27 _ W	Ramp/soak SKIP	Same as Coil #25

Totalizer Data (coils)

Coil #	Description	Reference Information
28 R W	Totalizer RUN	See Totalizer Operation in the IB-23C650 User's guide .
29 _ W	Totalizer RESET	Same as Coil #28

Autotune Data (coils)

Coil #	Description	Reference Information
30 R W	Autotune in progress - write to start, read for status	See <i>Table 13, Autotune Procedure</i> in the IB-23C650 User's Guide .
31 R W	Autotune the derivative response - in addition to P & I	Same as coil #30

Limit in Manual (coil)

Coil #	Description	Reference Information
32 R W	Apply output limits in MANUAL.	See <i>Table 4, Milliamp Output Setup Menu Step 8</i> in the IB-23C650 User's Guide .

CONTROLLER ATTRIBUTE LISTING - COIL DATA**Process Alarm Data (Coils)**

41 R _	Process alarm 1 active (Reg. # 9, PA1)	See Control Keys in the Basic Operation Section of the IB-23C650 User's Guide .
42 R W	Process alarm 1 unacknowledged (Reg. # 6, PA1)	Write to acknowledge process alarm from computer.
43 R _	Process alarm 2 active (Reg. # 9, PA2)	Same as coil #41
44 R W	Process alarm 2 unacknowledged (Reg. # 6, PA2)	Same as coil #42
45 R _	Process alarm 3 active (Reg. # 9, PA3)	Same as coil #41
46 R W	Process alarm 3 unacknowledged (Reg. # 6, PA3)	Same as coil #42
47 R _	Process alarm 4 active (Reg. # 9, PA4)	Same as coil #41
48 R W	Process alarm 4 unacknowledged (Reg. # 6, PA4)	Same as coil #42

CONTROLLER ATTRIBUTE LISTING - COIL DATA

Diagnostic Data (coils)

Coil #	Description	Reference Information
49 R _	Process fault diagnostic active (Reg. # 9, DIAG1)	See Operational Failure Messages in the Diagnostics Section of the IB-23C650 User's Guide .
50 R W	Process fault diagnostic unacknowledged (Reg. # 6, DIAG1)	Write to acknowledge diagnostic from computer.
51 R _	Input 2 fault diagnostic active (Reg. # 9, DIAG2)	Same as Coil #49
52 R W	Input 2 fault diagnostic unacknowledged (Reg. # 6, DIAG2)	Same as Coil #50
53 R _	Main calibration bad diagnostic active (Reg. # 9, DIAG3)	Same as Coil #49
54 R W	Main calibration bad diagnostic unacknowledged (Reg. # 6, DIAG3)	Same as Coil #50
55 R _	Option calibration bad diagnostic active (Reg. # 9, DIAG4)	Same as Coil #49
56 R W	Option calibration bad diagnostic unacknowledged (Reg. # 6, DIAG4)	Same as Coil #50
57 R _	Bad database checksum diagnostic active (Reg. # 9, DIAG5)	Same as Coil #49
58 R W	Bad database checksum diagnostic unacknowledged (Reg. # 6, DIAG5)	Same as Coil #50
59 R _	Computer writes inhibited diagnostic active (Reg. # 9, DIAG6)	See Diagnostic Messages in the Basic Operation With A Host Device Section of this supplement.
60 R W	Computer writes inhibited diagnostic unacknowledged (Reg. # 6, DIAG6)	Same as Coil #50
61 R _	Computer error diagnostic active (Reg. # 9, DIAG7)	Same as Coil #59
62 R W	Computer error diagnostic unacknowledged (Reg. # 6, DIAG7)	Same as Coil #50
63 R _	Instrument over configured diagnostic active (Reg. # 9, DIAG8)	Same as Coil #59
64 R W	Instrument over configured diagnostic unacknowledged (Reg. # 6, DIAG8)	Same as Coil #50

CONTROLLER ATTRIBUTE LISTING - COIL DATA**Ramp/Soak Profile Data (coils)**

73 R W	Ramp soak repeat	See <i>Table 9, Ramp/Soak Profile Setup Menu</i> in the IB-23C650 User's Guide .
74 R W	Ramp soak time base in hours	Same as Coil #73
75 R W	Ramp soak segment 1 relay A state on	Same as Coil #73
76 R W	Ramp soak segment 1 relay B state on	Same as Coil #73
77 R W	Ramp soak segment 1 relay C state on	Same as Coil #73
78 R W	Ramp soak segment 1 guaranteed Ramp or Soak	Same as Coil #73
79 R W	Ramp soak segment 2 relay A state on	Same as Coil #73
80 R W	Ramp soak segment 2 relay B state on	Same as Coil #73
81 R W	Ramp soak segment 2 relay C state on	Same as Coil #73
82 R W	Ramp soak segment 2 guaranteed Ramp or Soak	Same as Coil #73
83 R W	Ramp soak segment 3 relay A state on	Same as Coil #73
84 R W	Ramp soak segment 3 relay B state on	Same as Coil #73
85 R W	Ramp soak segment 3 relay C state on	Same as Coil #73
86 R W	Ramp soak segment 3 guaranteed Ramp or Soak	Same as Coil #73
87 R W	Ramp soak segment 4 relay A state on	Same as Coil #73
88 R W	Ramp soak segment 4 relay B state on	Same as Coil #73
89 R W	Ramp soak segment 4 relay C state on	Same as Coil #73
90 R W	Ramp soak segment 4 guaranteed Ramp or Soak	Same as Coil #73

CONTROLLER ATTRIBUTE LISTING - COIL DATA

Ramp/Soak Profile Data (coils) Cont'd

Coil. #	Description	Reference Information
91 R W	Ramp soak segment 5 relay A state on	See <i>Table 9, Ramp/Soak Profile Setup Menu</i> in the IB-23C650 User's Guide .
92 R W	Ramp soak segment 5 relay B state on	Same as coil # 91
93 R W	Ramp soak segment 5 relay C state on	Same as coil # 91
94 R W	Ramp soak segment 5 guaranteed Ramp or Soak	Same as coil # 91
95 R W	Ramp soak segment 6 relay A state on	Same as coil # 91
96 R W	Ramp soak segment 6 relay B state on	Same as coil # 91
97 R W	Ramp soak segment 6 relay C state on	Same as coil # 91
98 R W	Ramp soak segment 6 guaranteed Ramp or Soak	Same as coil # 91
99 R W	Ramp soak segment 7 relay A state on	Same as coil # 91
100 R W	Ramp soak segment 7 relay B state on	Same as coil # 91
101 R W	Ramp soak segment 7 relay C state on	Same as coil # 91
102 R W	Ramp soak segment 7 guaranteed Ramp or Soak	Same as coil # 91
103 R W	Ramp soak segment 8 relay A state on	Same as coil # 91
104 R W	Ramp soak segment 8 relay B state on	Same as coil # 91
105 R W	Ramp soak segment 8 relay C state on	Same as coil # 91
106 R W	Ramp soak segment 8 guaranteed Ramp or Soak	Same as coil # 91

CONTROLLER ATTRIBUTE LISTING - COIL DATA**Ramp/Soak Profile Data (coils) Cont'd**

Reg. #	Description	Reference Information
106 R W	Ramp soak segment 8 guaranteed Ramp or Soak	See <i>Table 9, Ramp/Soak Profile Setup Menu</i> in the IB-23C650 User's Guide .
107 R W	Ramp soak segment 9 relay A state on	Same as Coil #106
108 R W	Ramp soak segment 9 relay B state on	Same as Coil #106
109 R W	Ramp soak segment 9 relay C state on	Same as Coil #106
110 R W	Ramp soak segment 9 guaranteed R or S	Same as Coil #106
111 R W	Ramp soak segment 10 relay A state on	Same as Coil #106
112 R W	Ramp soak segment 10 relay B state on	Same as Coil #106
113 R W	Ramp soak segment 10 relay C state on	Same as Coil #106
114 R W	Ramp soak segment 10 guaranteed Ramp or Soak	Same as Coil #106

CONTROLLER ATTRIBUTE LISTING - COIL DATA

RECORD OF DATABASE**DESCRIPTION**

This section provides a table of the database fields for planning and recording your configuration entries via the RS-485 configuration menu. This database record provides a reference when entering the configuration and then a record of your configuration. Make copies of these pages as needed.

Blank fill-in fields on this table represents configuration fields that require a selection. Fields that are grayed-out either do not require a selection or are entry points into other parts of the menu. Refer to Table 1 for more information on the fields and valid entries.

NOTE: Database record tables for all other instrument setup menus are provided in **IB-23C650**.

CONTROLLER ATTRIBUTE LISTING - COIL DATA

Data Base Record					
Top Display	Middle Display	Bot. Disp. Entry	Top Display	Middle Display	Bot. Disp. Entry
RS-485	**MENU**		COMPUTER	SPMD VAL	
BUS	ENABLE		USE CMP	ACT TAG	
BUS	ADDRESS		COMPUTER	ACT TAG	
BAUD	RATE		CMP FAIL	SETUP	
PARITY	SELECT		CMP FAIL	CTL MODE	
STOP	BITS		CMP FAIL	OUTPUT	
ACCESS	TYPE		CMP FAIL	OUT VAL	
COMPUTER	SETUP		CMP FAIL	OUTPUT 2	
COMPUTER	TIMEOUT		CMP FAIL	OUT2 VAL	
CMP AUTO	MNEMONIC		CMP FAIL	RELAY A	
CMP MAN	MNEMONIC		CMP FAIL	RELAY B	
COMPUTER	MODE VAL		CMP FAIL	RELAY C	
CMP LOC	MNEMONIC		CMP FAIL	SPT MODE	
CMP LO2	MNEMONIC		CMP FAIL	SETPOINT	
CMP LO3	MNEMONIC		CMP FAIL	SPT VALU	
CMP LO4	MNEMONIC		BUS	ENABLE	
CMP REM	MNEMONIC				

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