

Modbus® RTU Serial Communications User Manual Configuration Interface for UDC2300

Supplement to 51-52-25-66

51-52-25-75

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Reference: Modicon Modbus Protocol Reference Guide – PI-MBUS-300 Rev. G

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About This Document

Abstract

This document provides configuration information specific to Honeywell's UDC2300 controllers and should be used in tandem with document number 51-52-25-66, Modbus® RTU Serial Communications User Manual.

Contacts

The following list identifies important contacts within Honeywell.

Service	Contact
Technical Support Please have your instrument's complete model number, serial number, and software version available.	1-800-423-9883
List of frequently asked questions and their answers	1-888-423-9883 (Honeywell's TACFACS— USA and Canada only) http://support.totalplant.honeywell.com (Honeywell's web site)

References

Publication Title	Publication Number
UDC 2300 Universal Digital Controller Product Manual	51-52-25-73
UDC2300 Universal Digital Limit Controller Product Manual	51-52-25-74
UDC2300 Universal Digital Controllers RS422/485 ASCII Communications Option Product Manual	51-52-25-85

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1. Overview of Modbus RTU Configuration Interface

This User Manual is intended to accompany the Modbus RTU Serial Communications User Manual (51-52-25-66). It describes the function codes needed to upload and download the configuration from a host computer into the UDC2300 controller.

2. Modbus RTU Function Codes

2.1 General Information

The UDC2300 uses a subset of the standard Modbus RTU function codes to provide access to process-related information. Several MODICON function codes are implemented. It is appropriate to define instrument-specific "user-defined" function codes. Where differences occur between the two protocols it will be noted. Several standard Modbus RTU function codes are supported.

Configuration ID Tags

The UDC2300 function codes **20** and **21** use the RS422/485 tag IDs for accessing configuration and process-related data. These tags are fully explained in *Section 3.10*.

The tag IDs represent the *register addresses* used in the Request Message.

Register Address Structure

Table 2-1 Integer Parameter Type

Register Numbers (Dec)	Name	Access	Notes
1	Type = 1	NOT SUPPORTED	16-bit Unsigned Integer
2	Attribute	NOT SUPPORTED	1 = Read Only, 2 = Read/Write
3	Value (16 bit integer)	Read / Write	
4	Not Used	NOT SUPPORTED	
5	Low Range (16 bit integer)	NOT SUPPORTED	
6	Not Used	NOT SUPPORTED	
7	High Range (16 bit Integer)	NOT SUPPORTED	
8	Not Used	NOT SUPPORTED	
9 to 13	Description Text (ASCII string)	NOT SUPPORTED	

Table 2-2 Floating Point Parameter Type

Register Numbers (Dec)	Name	Access	Notes
1	Type = 2	NOT SUPPORTED	IEEE Floating Point
2	Attribute	NOT SUPPORTED	1 = Read Only, 2 = Read/Write
3	Value (float high word)	Read / Write	
4	Value (float low word)	NOT SUPPORTED	
5	Low Range (float high word)	NOT SUPPORTED	
6	Low Range (float low word)	NOT SUPPORTED	
7	High Range (float high word)	NOT SUPPORTED	
8	High Range (float low word)	NOT SUPPORTED	
9 to 13	Description Text (ASCII string)	NOT SUPPORTED	

Register Count

The register count depends on the data format of the registers being read or written.

Integer data is represented in sixteen bits and is transferred high byte first.

Floating point data is transferred in IEEE 32-bit format.

The register count definitions are:

- 0001 = Integer Data
- 0002 = Floating Point Data

2.2 Function Code 20 (14h) - Read Configuration Reference Data

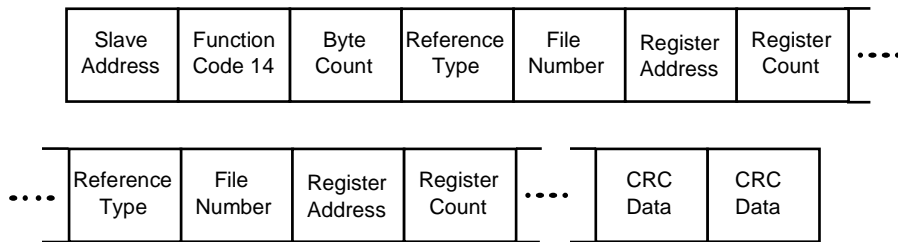
Description

Function code 20 (14 Hex) is used in the UDC2300 to read information stored in the UDC2300 configuration database. Each configuration item is explicitly addressed by a file number and register address. IEEE 32-bit floating point and 16-bit integer formats are supported.

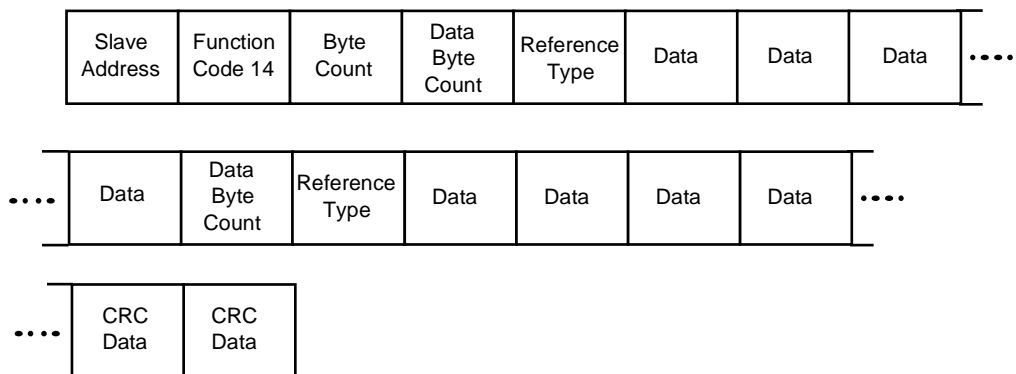
Request and Response Formats

The Request and Response formats for Function code 20 (14 Hex) are shown below. Details for each block reference follow.

Request Message Format



Response Message Format



Byte Count

The Byte Count equals the number of bytes transmitted in either the request or response message and will be the minimum number required to transmit all requested data.

Data Byte Count

The Data Byte Count is the number of data bytes of the *sub response* including the Reference Type but not including itself. A floating point sub response has four bytes of data and one byte representing the reference type making the data byte count equal to five.

Reference Type Definitions

The Reference Type definition is always 06.
See examples in Subsection 2.2.1

File Number

The file number word contains the register number from the register address structure tables on page 3. Although the register address structure tables indicate up to 13 data registers are available for access, only register address 3 is currently supported.

Register Address

The register address word represents the tag ID number for the parameter(s) being accessed. The register address word is made up of two bytes—the MSB = 00 always. The LSB contains the RS422 tag ID number. The tag ID numbers represent the parameter's register address(es). See Section 3 for the tag ID numbers.

Table 2-3 Register Address Format for Function Code 20

Register Address(es) (Decimal)	Register Address(es) (Hex)	Format
001 to 125	0001 to 007D	analog formatted data (2 registers – IEEE 32-bit floating point)
128 to 255	0080 to 00FF	integer formatted data (1 register – 16-bit integer)

2.2.1 Read Configuration Examples

Example #1

The following is an example of a request to read the Gain 1 value using Function code 20.

Request Message (Read (Gain 1) = ID Tag 001) 02 14 07 06 00 03 00 01 00 02 (CRC16)
--

Where:

02	=	Address
14	=	Function Code 20 (14 hex)
07	=	Byte Count
06	=	Reference Type
00,03	=	File Number (Access Data Value)
00,01	=	Register Address (Standard Access Gain 1 - Tag ID #1)
00 02	=	Register Count (Floating Point Data)
(CRC16)		

This is the response to the above request.

Response Message 02 14 06 05 06 3F C0 00 00 (CRC16)

Where:

02	=	Address
14	=	Function Code 20 (14 Hex)
06	=	Byte Count
05	=	Sub Message Length
06	=	Reference Type (IEEE Floating Point)
3F C0 00 00	=	1.50 (Value of Proportional Band)
(CRC16)		

Read Configuration Examples, continued

Example #2

The following is another example of a request and response message using Function code 20.

Request Message (Read LSP #1 = ID Tag 39 and LSP #2 = ID Tag 53)

02 14 0E 06 00 03 00 27 00 02 06 00 03 00 35 00 02 (CRC16)

Where:

02 = Address
 14 = Function Code 20 (14 Hex)
 0E = Byte Count
 06 = Reference Type (IEEE Floating Point)
 00,03 = File Number (Access Data Value)
 00,27 = Register Address (Standard Access LSP #1 - ID Tag 39)
 00,02 = Register Count to read (Floating Point Data)
 06 = Reference Type (IEEE Floating Point)
 00,03 = File Number (Access Data Value)
 00,35 = Register Address (Standard Access LSP #2 - ID Tag 53)
 00,02 = Register Count to read (Floating Point Data)
 (CRC16)

This is the response to the above request.

Response Message

02 14 0C 05 06 43 C8 00 00 05 06 44 60 00 00 (CRC16)

Where:

02 = Address
 14 = Function Code 20 (14 Hex)
 0C = Byte Count
 05 = Data Byte Count (Sub Message Length)
 06 = Reference Type (IEEE Floating Point)
 43 C8 00 00 = 400.0 (Value of Local Setpoint #1)
 05 = Data Byte Count (Sub Message Length)
 06 = Reference Type (IEEE Floating Point)
 44 60 00 00 = 896.0 (Value of Local Setpoint #2)
 (CRC16)

Continued next page

2.3 Function Code 21 (15h) - Write Configuration Reference Data

Introduction

Function Code 21 (15 Hex) is used in the UDC2300 to allow writes of integer and floating point values to the UDC2300 configuration database and override values.

The configuration database of the UDC2300 is located in EEROM. The override values are stored in RAM.

Integer format is used to write to “Digital” configuration items. Floating Point format is used to write to “Analog” configuration items as defined by the configuration ID tags.

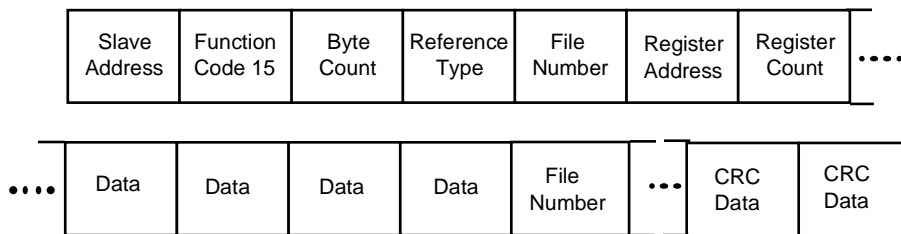
Write Restrictions

Care should be taken not to exceed the 100,000 write limit of the UDC2300 EEROM.

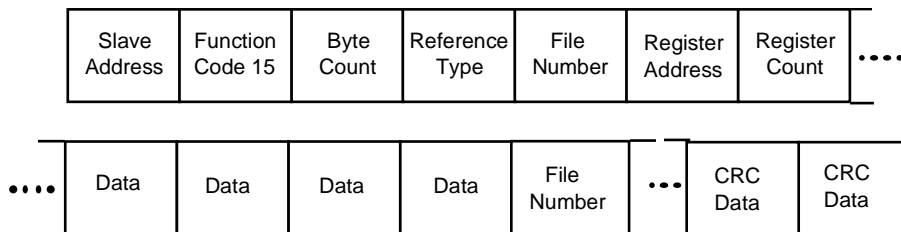
Request and Response Formats

The Request and Response formats for Function code 21 (15 Hex) are shown below. Details for each block reference follow.

Request Message Format



Response Message Format (echo back of request)



The register address is interpreted by the UDC2300 as the tag ID configuration number.

Reference Type Definitions

The Reference Type definition is always 06.
See examples in Subsection 2.3.1

File Number

The file number word contains the register number from the register address structure tables on page 3. Although the register address structure tables indicate up to 13 data registers are available for access, only register address 3 is currently supported.

Register Address

The register address is used to designate the tag ID number for the parameter being accessed. The register address is made up of two bytes—the MSB = 00 always. The LSB contains the RS422 tag ID number. The tag ID numbers represent the parameter's register address(es). See *Section 3* for the tag ID numbers.

Table 2-4 Register Address Format for Function Code 21

Register Address(es) (Dec)	Register Address(es) (Hex)	Format
001 to 125	0001 to 007D	analog formatted data (2 registers – IEEE 32-bit floating point)
128 to 215 & 255	0080 to 00D7 & 00FF	integer formatted data (2 registers – IEEE 32-bit floating point)

Unrestricted Registers

As mentioned previously, all register data is stored in the EEROM of the UDC2300 with some exceptions. These exceptions were made to allow write access to override information. The registers, which are designated as Override values, are listed below. These registers do not have restrictions on the number of writes.

<i>ID Tag</i>	<i>Register Number</i>	<i>UDC2300 Usage</i>
123	(7Bh)	Output Override
125	(7Dh)	Computer Setpoint

Restrictions on Parameter Numbers in One Message

The maximum number of writeable parameters per write request is 1.

2.3.1 Write Configuration Examples

Example #1

The following is an example of a request to write the Gain 1 value using Function code 21 (15 Hex).

Request Message (Write Gain 1= 1.5 “ID Tag 1”)
 02 15 0B 06 00 03 00 01 00 02 3F C0 00 00 (CRC16)

Where:

- 02 = Address
- 15 = Function Code 21 (15 Hex)
- 0B = Byte Count
- 06 = Reference Type (IEEE Floating Point)
- 00 03 = File Number (Access Data Value)
- 00 01 = Register Address (Standard Access - Gain 1 - ID Tag 1)
- 00 02 = Register Count (Floating Point Data)
- 3F C0 00 00 = 1.50
(CRC16)

This is the response to the above request.

Response Message (The response is an echo of the request)
 02 15 0B 06 00 01 00 02 00 02 3F C0 00 00 (CRC16)

3. Read, Write, and Override Parameters

3.1 Overview

Introduction

This section contains information concerning Reading, Writing, and Overriding parameters in the UDC 2300 Process Controller. There are two types of parameters:

- **Data Transfer**—These parameters include reading control data, option status, and reading or changing setpoints or output.
- **Configuration Data**—All the configuration data is listed in the order in which it appears in the controller.

Each type of parameter has the identifying codes listed with it.

Section Contents

This section contains the following topics:

<i>Topic</i>	<i>See Page</i>
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3.3 Read Option Status _____	13
3.4 Miscellaneous Read Only's _____	14
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• Algorithm _____	29
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• Input 2 _____	33
• Control _____	35
• Communications _____	36
• Alarms _____	37

General Information

Analog Parameters

- Whenever analog register addresses 0001 through 0072 (those that can be changed via communications) are changed, a Write cycle occurs after receipt of the message and the response is returned.

Override Parameters

- Override analog register addresses 0078, 007B and 007D (PV, output, and computer setpoint) are not stored in nonvolatile memory. They can be changed as frequently as desired with no effect on nonvolatile memory retentivity, but the controller must remain in the slave mode.

Digital Parameters

- Whenever digital configuration register addresses 0080 through 00FA are updated via communications, the nonvolatile memory is updated as soon as the message is received.

3.2 Reading Control Data

Overview

You can Read the following control data from the UDC controller.

- Input 1
- Input 2
- PV
- Internal RV

Register Addresses

Use the identifying codes listed in Table 3-1 to read the specific items.

A Write request for these codes will result in an Error message.

Table 3-1 Control Data Parameters

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Input #1	0076	118	FP	RD	In Engineering Units or Percentage
Input #2	0077	119	FP	RD	In Engineering Units or Percentage
PV	0078	120	FP	RD	In Engineering Units or Percentage
Internal RV	0079	121	FP	RD	In Engineering Units or Percentage

3.3 Read Options Status

Read

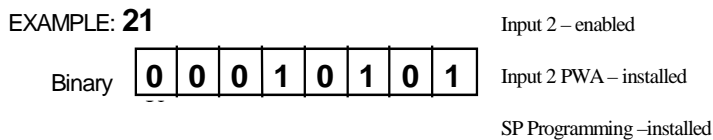
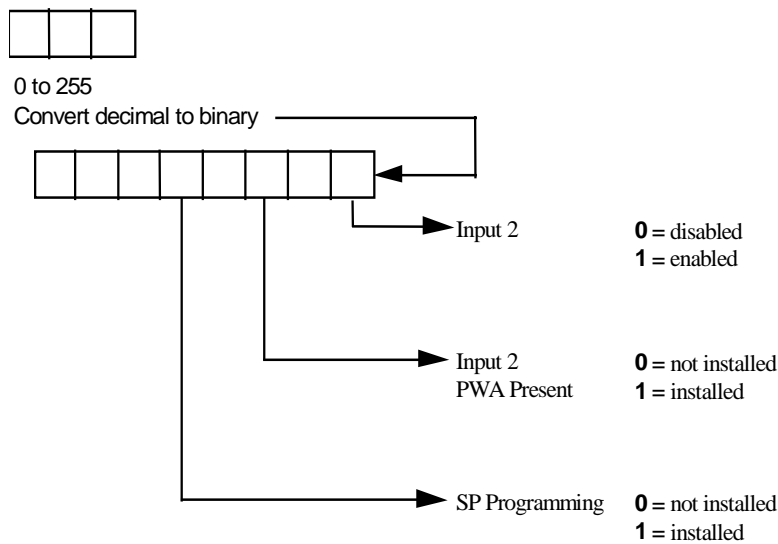
Doing a Read of register address 00B9 listed in Table 3-2 will tell you which of the available options are enabled / installed or disabled / not installed.

Table 3-2 Option Status

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Option Status (Read only)	00B9	185	INT	RD	See Figure 3-1.

The data field in the response message will be a decimal number from 0 to 255. Convert the decimal number to binary as shown in

Figure 3-1 to determine which options are or are not active.



24190

Figure 3-1 Option Status Information

3.4 Miscellaneous Read Only's

3.4.1 Register Addresses for Read Only's

The identifying register addresses listed in Table 3-3 represent some information that is Read only. No Writes allowed.

Table 3-3 Miscellaneous Read Only's

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Software Type	009D	157	INT	RD	READ only (UDC 2300) A1 = Basic UDC 2300 software A2 = Limit Controller
Software Version	00A7	167	INT	RD	READ only 0 to 255
UDC Error Status (Definitions are listed in Table 3-4)	00FF	255	INT	RD	See below READ/WRITE* 01 = Emergency Manual 02 = Failsafe 04 = Working Calibration Checksum Error 08 = Configuration Checksum Error 10 = Factory Calibration Error 20 = Hardware Failure 40 = Restart after Shed 80 = Configuration/Calibration Memory Changed

*Write to clear.

FOR EXAMPLE:

If Read returns C0 [restart after shed (40) plus configuration change (80)]

Write anything to Register address 00FF.

Read returns 00 (clear).

3.4.2 Error Status Definitions

Table 3-4 lists the UDC error status codes and their definitions.

Table 3-4 Error Status Definitions

Code	Error	Definitions
01	Emergency Manual	Indicates that the output of the unit, which has been in slave operation, is under manual control locally. Error remains until local control is relinquished at the controller.
02	Failsafe	Error occurs whenever the control reverts to failsafe operation and remains as long as the condition exists.
04	Working Calibration Checksum Error	Indicates that an error exists in the working calibration data. Re-select the inputs to load factory calibration data or field calibrate the inputs.

Table continued on next page

Table 3-4 Error Status Definitions, continued

Code	Error	Definitions
08	Configuration Checksum Error	Error exists in the configuration data. Verify configuration data at the keyboard. Checksum will be recomputed by stepping the controller through the status tests.
10	Factory Calibration Error	Error exists in the factory calibration data and remains as long as the condition exists.
20	Hardware Failure	Indicates either a RAM test failure or Input 1, Input 2 failure on two consecutive conversions.
40	Restart After Shed	Error occurs whenever a shed of slave override is performed. Error is reset following a Write command to register address 00FF (064).
80	Configuration/ Calibration Memory Changed	Error occurs whenever shed, configuration, or calibration changed. Also occurs whenever there is a change of state in 001, 002, 004, 008, or 016. Error is reset following a Write command to register address 00FF.

3.5 Setpoints

Overview

You can use three separate local setpoints in the UDC Controller. The identifying register addresses listed in Table 3-5 allow you to select which setpoint you want to use and to enter a value in Engineering Units (whichever is selected at register address 00A1) for that setpoint via communications.

Register Addresses

Make your selection using register address 00AD and enter the value for the setpoint chosen using register address in Table 3-5.

Table 3-5 Setpoint Code Selections

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Local Setpoint #1	0027	039	FP	R/W	Value within the setpoint range limits
Local Setpoint #2	0035	053	FP	R/W	Value within the setpoint range limits
Number of Local Setpoints	00AD	173	INT	R/W	00 = Local Setpoint #1 only 01 = 2nd Local Setpoint via keyboard or communications

Associated Parameters

Refer to Table 3-6 to display or change any of the parameters associated with the setpoint.

Table 3-6 Setpoint Associated Parameters

Parameter	Register Address	
	Hex	Decimal
Setpoint Limits	0007, 0008	007, 008
Computer Setpoint	007D	125

3.6 Using a Computer Setpoint (Overriding Controller Setpoint)

Overview

You can use a setpoint generated from the computer to override the setpoint being used by the controller. The value generated by the computer will have ratio and bias applied by the controller.

Register Addresses

Use the identifying code in Table 3-7 to enter the computer setpoint.

Table 3-7 Computer Setpoint Selection

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Computer Setpoint	007D	125	FP	R/W	Value from computer with Ratio and Bias applied by the controller. Within the Setpoint Range Limits in Engineering Units or Percent.

Shed

The computer setpoint override will continue until SHED from communications occurs or the controller is placed into monitor mode through communications. Doing periodic SLAVE READS within the shed time will allow the override to continue until communication is stopped and shed time elapses.

ATTENTION

0 Shed (code 154) allows the override to continue indefinitely or until the reset shed timer register address 1B90 is written using function code 6. Any data value can be written because it is ignored. (See override selections in Table 3-9.)

When SP is overridden, the upper display becomes "CSP," (momentarily, and the lower display contains the prompt CS followed by the value CSXXXX).

Associated Parameters

Refer to Table 3-8 for the codes to display or change any of the parameters associated with the computer setpoint.

Table 3-8 Computer Setpoint Associated Parameters

Parameter	Register Address	
	Hex	Decimal
Setpoint Limits	0007, 0008	007, 008
Local Setpoint #1	0027	039
Local Setpoint #2	0035	053
Local Setpoint Selection	00AD	173
Computer Setpoint Ratio	0015	021
Computer Setpoint Bias	0016	022

3.7 PV or Setpoint Override Selections

Overview

You can **Read** the present override status or the PV or setpoint, or you can do a **Write** transaction to cancel the override.

Register Addresses

Use the identifying code in Table 3-9 to Read or Write your selection.

Table 3-9 PV or Setpoint Override Selections

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
PV or Setpoint Override Selection	00B7	183	INT	R/W	01 = Input 1 02 = Input 2 04 = PV 08 = Setpoint Limit Controller (Read Only) 0 = Unlatched 1 = Latched Relay

3.8 Reading or Changing the Output

Overview

You can read the output of a particular UDC controller (Read transaction) or you can change it to suit your needs. (Do a Write transaction.)

ID Codes

Use the identifying code in Table 3-10 to monitor (Read) or change (Write) the output (in manual only).

ATTENTION

- To Write (change) the output, the controller must first be in manual mode.

Table 3-10 Reading or Changing the Output

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Output	007B	123	FP	R/W	–5 to +105% of full span (current output) 0 to 100% (relay type output)

Associated Parameters

Refer to Table 3-11 for the codes required to display or change any of the parameters associated with the output.

Table 3-11 Associated Output Codes

Parameter	Register Address	
	Hex	Decimal
Output Limits	000E, 000F	014, 015
Failsafe Output Values	0028	040
Output Deadband	0012	018
Output Hysteresis	0013	019
Output Type	00A0	160

3.9 Local Setpoint/PID Selection/Setpoint Ramp Status

Overview

Identifying code 250 lets you monitor or make selections for:

- Tuning Parameter Set #1 or #2
If Tuning Sets selection is “two keyboard” code 172 = 001
- Local Setpoint #1, #2
If “2 Local Setpoints” is selected 131 = 0, 173 = 1
- Run or Hold Setpoint Ramp or a Setpoint Program Data
If SP Ramp or SP Program is enabled 178 = 1 Program, 178 = 2 Ramp

Read

Table 3-12 is a list of numbers that could be returned by the UDC 2300 controller. When a Read is requested for this ID Code (250) you can determine which parameters are active from this table.

Write

To Write information to the controller, select what parameters you want from Table 3-12 and enter the associated number in the data field of the Write request.

FOR EXAMPLE:

- Current selection of TUNING SET #1
- Maintain LOCAL SETPOINT #1
- Maintain SP Ramp in Hold
- CHANGE to TUNING SET #2

READ 250 response is 00 or 02

WRITE 250 (07)

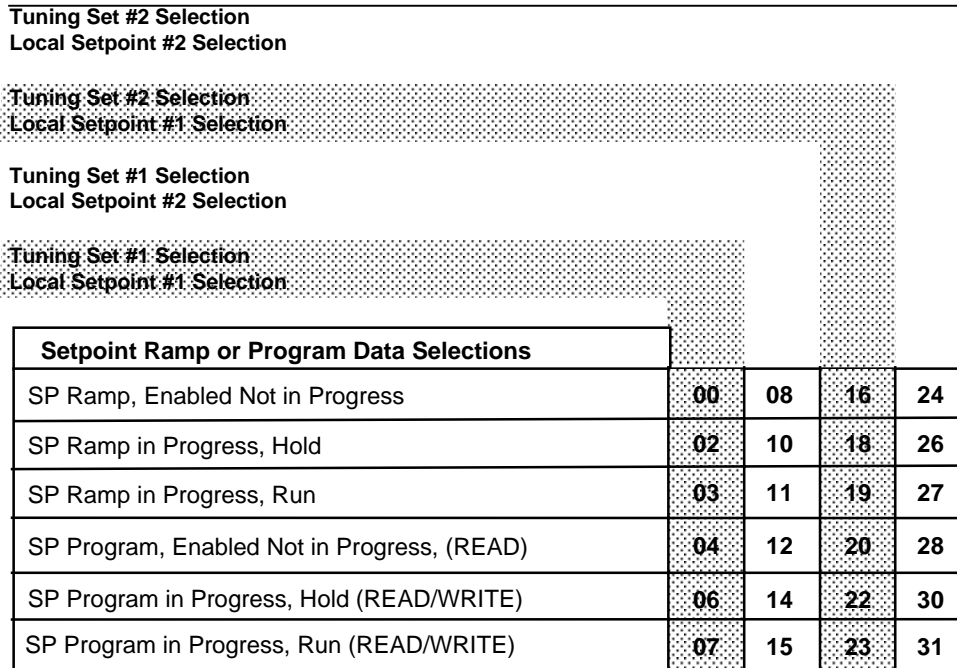
READ 250 Response is 08 or 010

ATTENTION

- Some of the numbers are Read only.
-

Table 3-12 LSP/PID Set Selection and Setpoint Ramp Status

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Enhanced Function	00FA	250	INT	R	See code 250 indications listed in Figure 3-2. Note: The numbers in the table below are represented in decimal.



24192A

Figure 3-2 Code 250 Read Indications

A write of code 250 lets you change the SP ramp status as well as the local setpoint or tuning set selection. Refer to Table 3-13.

Table 3-13 ID Code 250 Writes

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Write Local Setpoint/PID Set Selection and SP Ramp Status	00FA	250	INT	W	00 = Abort SP Ramp 01 = Run SP Ramp 02 = Hold SP Ramp 03 = Start SP Ramp 04 = Change to Local Setpoint #1 05 = Change to Local Setpoint #2 06 = Change to PID Tuning Set #1 07 = Change to PID Tuning Set #2

ATTENTION

To enable or disable the setpoint ramp, refer to Identifying Code 150.

3.10 Configuration Parameters

Overview

Listed on the next pages are the identifying codes for the parameters in the various Set-up Groups in the UDC2300 Process Controller. The Set-up Groups and their table numbers are listed below. Most of the parameters are configurable through the hosts. Some are Read Only and are indicated as such and cannot be changed.

<i>Set-up Group</i>	<i>Table Number</i>
Timing _____	Table 3-14
Tuning _____	Table 3-15
SP Ramp/Rate/Program _____	Table 3-16
Accutune _____	Table 3-17
Algorithm _____	Table 3-18
Input 1 _____	Table 3-19
Input 2 _____	Table 3-20
Control _____	Table 3-21
Communications _____	Table 3-22
Alarms _____	Table 3-23

Reading or Writing

Do a Read or Write, depending on your requirements, using the identifying code and format code listed in the tables. The range or selection available for each range is listed in the tables.

3.10.1 Timing

Table 3-15 lists all the register addresses and ranges or selections for the function parameters in the Set-up Group Timing.

Table 3-14 Set-up Group – Timer

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Timer	00D8	216	INT	R/W	0 = Disable 1 = Enable
Period	0063	099	FP	R/W	00.00 TO 99.59
Start (Initiation)	00D9	217	INT	R/W	0 = Key (Run/Hold Key) 1 = Alarm 2
LDISP (Selection)	00DA	218	INT	R/W	6 = TI REM 1 = Elapsed Time
Timer Reset	00D6	214	INT	R/W	0 = Key (Run/Hold Key) 1 = AL1 (Alarm 1 or Key)
Timer Increment	00D7	215	INT	R/W	0 = Min (Counts hr/min) 1 = Sec (Counts min/sec)

3.10.2 Tuning

Table 3-15 lists all the register addresses and ranges or selections for the function parameters in the Set-up Group Tuning.

Table 3-15 Set-up Group – Tuning

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Gain #1 or PB Note 1	0001	001	FP	R/W	0.01 to 1000 Gain 0.1 to 9999 PB
Rate #1 Note 1	0002	002	FP	R/W	0.00 to 10.00
Reset #1 Note 1	0003	003	FP	R/W	0.02 to 50.00
Manual Reset	000D	013	FP	R/W	-100 to +100

Table continued on next page

Table 3-15 Set-up Group – Tuning, continued

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Gain #2 or PB #2 Note 1	0004	004	FP	R/W	0.01 to 1000
Rate #2 Note 1	0005	005	FP	R/W	0.00 to 10.00
Reset #2 Note 1	0006	006	FP	R/W	0.02 to 50.00
Cycle Time #1	009E	158	INT	R/W	1 to 120 seconds
Cycle Time #2	009F	159	INT	R/W	1 to 120 seconds
Lockout (keyboard only) Changes to data are always possible via communications regardless of this configuration.	0084	132	INT	R/W	0 = No Lockout 1 = Calibration Locked out 2 = Timer, Tuning, SP Ramp, Accutune are read/write 3 = Tuning and SP Ramp are read/write, no other parameters are available 4 = Maximum Lockout

Table continued on next page

Table 3-15 Set-up Group – Tuning, continued

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Keyboard Lockout	00BF	191	INT	R/W	0 = All keys enabled 1 = Manual Auto Key Locked 2 = Setpoint Select Key Locked 3 = Manual/Auto and Setpoint Select Keys Locked 4 = Run Hold Key Locked 5 = Run Hold Key and Manual/Auto Keys Locked 6 = Run Hold Key and Setpoint Select Keys Locked 7 = Run Hold, Setpoint Select, and Manual/Auto Keys Locked 8 = Autotune Key Locked 9 = AT + MA 10=AT + SS 11=AT + SS + MA Locked 12=AT + RH Locked 13=AT + RH + MA Locked 14=AT + RH + SS Locked 15=AT + RH + SS + MA Locked

NOTE 1: Writes to these locations are not available when Accutune is enabled.

3.10.3 SP Ramp/Rate/Program

Table 3-16 lists all the register addresses and ranges or selections for the function parameters in Set-up Group Setpoint Ramp/Rate.

Table 3-16 Set-up Group – Setpoint Ramp/Rate

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Setpoint Program Ramp Selection	00B2	178	INT	R/W	0 = SP Program, Rate, and Ramp Disabled 1 = SP Program Enabled 2 = SP Ramp Enabled 3 = SP Rate Enabled
SP Ramp	0096	150	INT	R/W	0 = OFF 2 = Enabled
Single SP Ramp Time	00AE	174	INT	R/W	0 to 255 (minutes)
Final Ramp SP Value	001A	026	FP	R/W	PV Range in Engineering Units
SP Rate					
Rate Up (EU/HR)	006C	108	FP	R/W	0 to 9999
Rate Down (EU/HR)	006D	109	FP	R/W	0 to 9999
SP Program					
Start Segment #	00AF	175	INT	R/W	1 to 11
End Segment #(Soak)	00B0	176	INT	R/W	2, 4, 6, 8, 10, or 12
Engineering Units or Ramp Segments	00B6	182	INT	R/W	0 = HRS:MIN 1 = Degrees/Minute
Program Recycles	00B1	177	INT	R/W	0 to 99
Guaranteed Soak Deviation	0057	087	FP	R/W	0 to 99.9 (0 = no soak)
Program End State	00B5	181	INT	R/W	0 = Disable SP Program 1 = Hold at Program End
Controller Status at Program End	00B4	180	INT	R/W	0 = Last Setpoint and Mode 1 = Manual, Failsafe Output
Reset SP Program (ToBEGIN)	00B3	179	INT	R/W	0 = Disable 1 = Via Keypad 2 = Rerun
Segment #1 Ramp Time	0039	057	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment #2 Soak Setpoint Value	003A	058	FP	R/W	Within Setpoint Limits
Segment #2 Soak Time	003B	059	FP	R/W	99.59 (0-99 Hrs:0-59 Min)

Table 3-16 Set-up Group – Setpoint Ramp/Rate, continued

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Segment #3 Ramp Time	003C	060	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment #4 Soak Setpoint Value	003D	061	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment #4 Soak Time	003E	062	FP	R/W	99.59 (0-99 Hrs:0-59 Min)
Segment #5 Ramp Time	003F	063	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment #6 Soak Setpoint Value	0040	063	FP	R/W	Within Setpoint Limits
Segment #6 Soak Time	0041	065	FP	R/W	99.59 (0-99 Hrs:0-59 Min)
Segment #7 Ramp Time	0042	066	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment #8 Soak Setpoint Value	0043	067	FP	R/W	Within Setpoint Limits
Segment #8 Soak Time	0044	068	FP	R/W	99.59 (0-99 Hrs:0-59 Min)
Segment #9 Ramp Time	0045	069	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment #10 Soak Setpoint Value	0046	070	FP	R/W	Within Setpoint Limits
Segment #10 Soak Time	0047	071	FP	R/W	99.59 (0-99 Hrs:0-59 Min)
Segment #11 Ramp Time	0048	072	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment #12 Soak Setpoint Value	0049	073	FP	R/W	Within Setpoint Limits
Segment #12 Soak Time	004A	074	FP	R/W	99.59 (0-99 Hrs:0-59 Min)

3.10.4 Accutune

Table 3-17 lists all the register addresses and ranges or selections for the function parameters in Set-up Group Adaptive Tune.

Table 3-17 Set-up Group – Adaptive Tune

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Fuzzy Overshoot Suppression	00C1	193	INT	R/W	0 = Disabled 1 = Enabled
Accutune Enable	0098	152	INT	R/W	0 = Accutune Disabled 1 = Tune
Accutune Error (Read only)	0097	151	INT	R/W	0 = None 3 = Process Identification failed 4 = Accutune aborted on command 5 = Running

3.10.5 Algorithm

Table 3-18 lists all the register addresses and ranges or selections for the function parameters in Set-up Group Algorithm.

Table 3-18 Set-up Group – Algorithm

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Control Algorithm Selection (Selection here will affect ID code 160 in Output Algorithms.)	0080	128	INT	R/W	0 = ON/OFF 1 = PID-A 2 = PID-B 3 = PD-A with Manual Reset 4 = Three Position Step
Output Algorithm	00A0	160	INT	R/W	0 = Time Simplex Relay 1 1 = Time Simplex Relay 2 2 = Current Simplex 3 = TPSC 4 = Time Duplex 5 = Current Duplex 6 = Current/Time Duplex 7 = Time/Current Duplex
Relay Cycle Time Increments	00BE	190	INT	R/W	0 = 1 second increments 1 = 1/3 second increments

3.10.6 Input 1

Table 3-19 lists all the register addresses and ranges or selections for the function parameters in Set-up Group Input 1.

Table 3-19 Set-up Group – Input 1

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Decimal Point Location	009B	155	INT	R/W	0 = XXXX – Fixed 1 = XXX.X – Floating decimal point to one 2 = XX.XX – Floating decimal point to two 3 = X.XXX – Floating decimal point to three
Temperature Units	0081	129	INT	R/W	0 = °F 1 = °C 2 = None

Table continued on next page

Table 3-19 Setup Group – Input 1, continued

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Input 1 Type	00A8	168	INT	R/W	1 = B TC 2 = E TC H 3 = E TC L 4 = J TC H 5 = J TC L 6 = K TC H 7 = K TC L 8 = NNM H 9 = NNM L 10 = NM90 H 11 = NM90 L 12 = Nicrosil TC 13 = R TC 14 = S TC 15 = T TC H 16 = T TC L 17 = W TC H 18 = W TC L 19 = 100 PT RTD 20 = 100 PT LO RTD 21 = 200 PT RTD 22 = 500 PT RTD 23 = Radiamatic RH 24 = Radiamatic RI 25 = 0-20 mA 26 = 4-20 mA 27 = 0-10 mV 28 = 0-50 mV 29 = 0-5 Vdc 30 = 1-5 Vdc 31 = 0-10 Vdc 32 = Unused 33 = 100 M
ATTENTION					
Changing the Input Type will result in the loss of Field Calibration values and will restore the Factory Calibration values.					

Table continued on next page

Table 3-19 Setup Group – Input 1, continued

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Input 1 Transmitter Characterization	00A9	169	INT	R/W	0 = B TC 1 = E TC H 2 = E TC L 3 = J TC H 4 = J TC L 5 = K TC H 6 = K TC L 7 = NNM TC H 8 = NNM TC L 9 = NM90 H 10 = NM90 L 11 = Nicrosil TC 12 = R TC 13 = S TC 14 = T TC H 15 = T TC L 16 = W TC H 17 = W TC L 18 = 100 PT RTD 19 = 100 PT LO RTD 20 = 200 PT RTD 21 = 500 PT RTD 22 = Radiamatic RH 23 = Radiamatic RI 24 = Linear 25 = Square Root
Input 1 High Range Value	001D	029	FP	R/W	–999. to 9999. Engineering Units (Linear types only)
Input 1 Low Range Value	001E	030	FP	R/W	–999 to 9999. Engineering Units (Linear types only)
Input 1 Ratio	006A	106	FP	R/W	–20.00 to 20.00
Input 1 Bias	006B	107	FP	R/W	–999 to 9999. Engineering Units
Input 1 Filter	002A	042	FP	R/W	0 to 120 seconds
Burnout (Open Circuit Detection)	00A4	164	INT	R/W	0 = None and Failsafe 1 = Upscale 2 = Downscale 3 = No F.S.
Emissivity	0017	023	FP	R/W	0.01 to 1.00
Power Frequency	00A6	166	INT	R/W	0 = 60 Hertz 1 = 50 Hertz

Table continued on next page

Table 3-19 Setup Group – Input 1, continued

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Display	00BA	186	INT	R/W	0 = SP (setpoint) 1 = PRY (PV with label) 2 = PRN (PV without label)
Language (Displays)	00C0	192	INT	R/W	0 = English 1 = French 2 = German 3 = Spanish 4 = Italian

3.10.7 Input 2

Table 3-20 lists all the register addresses and ranges or selections for the function parameters in Set-up Group Input 2.

Table 3-20 Set-up Group – Input 2

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Input 2 Type	00AA	170	INT	R/W	0 = Disable 1 to 24 Unused 25 = 0-20 mA 26 = 4-20 mA 29 = 0-5 Vdc 30 = 1-5 Vdc 31 = Unused 32 = Slidewire 33 = Unused 34 = 0 – 2 vdc
ATTENTION					
Changing the Input Type will result in the loss of Field Calibration values and will restore the Factory Calibration values.					

Table continued on next page

Table 3-20 Setup Group – Input 2, continued

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Input 2 Transmitter Characterization	00AB	171	INT	R/W	0 = B TC 1 = E TC H 2 = E TC L 3 = J TC H 4 = J TC L 5 = K TC H 6 = K TC L 7 = NNM TC H 8 = NNM TC L 9 = NM90 H 10 = NM90 L 11 = Nicrosil TC 12 = R TC 13 = S TC 14 = T TC H 15 = T TC L 16 = W TC H 17 = W TC L 18 = 100 PT RTD 19 = 100 PT LO RTD 20 = 200 PT RTD 21 = 500 PT RTD 22 = Radiamatic RH 23 = Radiamatic RI 24 = Linear 25 = Square Root
Input 2 High Range Value	0023	035	FP	R/W	–999. to 9999. Engineering Units
Input 2 Low Range Value	0024	036	FP	R/W	–999 to 9999. Engineering Units
Input 2 Ratio	0025	037	FP	R/W	–20.00 to 20.00
Input 2 Bias	0026	038	FP	R/W	–999 to 9999. Engineering Units
Input 2 Filter	002B	043	FP	R/W	0 to 120 seconds

3.10.8 Control

Table 3-21 lists all the register addresses and ranges or selections for the function prompts in Set-up Group Control.

Table 3-21 Set-up Group – Control

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection												
	Hex	Decimal															
Tuning Parameter Selection	00AC	172	INT	R/W	0 = One set only 1 = 2 sets keyboard selected 2 = 2 sets with PV automatic switchover 3 = 2 sets with setpoint (SP) automatic switchover												
Automatic Switchover Value (used with 172 selection 2 or 3)	0038	056	FP	R/W	Within the PV Range in engineering units												
Local Setpoint Source (Number of LSPs)	00AD	173	INT	R/W	0 = One Local Setpoint 1 = Two Local Setpoints (disables RSP)												
Power Up Mode Recall	0082	130	INT	R/W	<table border="0"> <tr> <td>Control Mode</td> <td>Setpoint Mode</td> </tr> <tr> <td>0 = MAN</td> <td>LSP</td> </tr> <tr> <td>1 = AUTO</td> <td>LSP</td> </tr> <tr> <td>2 = AUTO</td> <td>Last RSP</td> </tr> <tr> <td>3 = LAST</td> <td>Last SP</td> </tr> <tr> <td>4 = LAST</td> <td>Last local SP</td> </tr> </table>	Control Mode	Setpoint Mode	0 = MAN	LSP	1 = AUTO	LSP	2 = AUTO	Last RSP	3 = LAST	Last SP	4 = LAST	Last local SP
Control Mode	Setpoint Mode																
0 = MAN	LSP																
1 = AUTO	LSP																
2 = AUTO	Last RSP																
3 = LAST	Last SP																
4 = LAST	Last local SP																
RSP Source	0083	131	INT	R/W	0 = None 1 = Input 2												
Setpoint Tracking	008A	138	INT	R/W	0 = None 1 = LSP = PV (when in Manual) 2 = LSP = RSP (when switched)												
Control Setpoint High Limit	0007	007	FP	R/W	0 to 100% of PV (engineering units)												
Control Setpoint Low Limit	0008	008	FP	R/W	0 to 100% of PV (engineering units)												
Control Output Direction/Alarm Outputs	0087	135	INT	R/W	0 = Direct Action Alarm Output energized 1 = Direct Action Alarm Output de-energized 2 = Reverse Action Alarm Output energized 3 = Reverse Action Alarm Output de-energized												

Table continued on next page

Table 3-31 Set-up Group – Control, continued

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
High Output Limit	000E	014	FP	R/W	-5 to 105% of output
Low Output Limit	000F	015	FP	R/W	-5 to 105% of output
Output Deadband	0012	018	FP	R/W	-5 to +25.0% Time Duplex 0.5 to 5.0% (3 pos step)
Output Hysteresis	0013	019	FP	R/W	0.0 to 100.0% of PV
Failsafe Mode	00D5	213	INT	R/W	0 = Latching 1 = Non latching
Failsafe Output Level	0028	040	FP	R/W	0 to 100%
Proportional Band Units	0094	148	INT	R/W	0 = Gain 1 = Proportional band
Reset Units	0095	149	INT	R/W	0 = Minutes 1 = RPM

3.10.9 Communications

Table 3-22 lists all the register addresses and ranges or selections for the function parameters in Set-up Group Communications.

Table 3-22 Set-up Group – Communications

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Shed Time	009A	154	INT	R/W	0 = No Shed 1 = 255 sample periods
Shed Mode and Output	00A2	162	INT	R/W	0 = Last Mode and Last Output 1 = Manual Mode, Last Output 2 = Manual Mode, Failsafe Output 3 = Automatic Mode
Shed Setpoint Recall	00A3	163	INT	R/W	0 = To Last Local Setpoint used 1 = Last Setpoint prior to Shed
Computer Setpoint Ratio	0015	021	FP	R/W	-20.00 to 20.00
Computer Setpoint Bias	0016	022	FP	R/W	-999 to 9999.

3.10.10 Alarms

Table 3-23 lists all the register addresses and ranges or selections for the function parameters in Set-up Group Alarms.

Table 3-23 Set-up Group – Alarms

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Alarm 1 Setpoint 1 Value	0009	009	FP	R/W	Within the range of selected parameter or PV span for deviation alarm
Alarm 1 Setpoint 2 Value	000A	010	FP	R/W	Within the range of selected parameter or PV span for deviation alarm
Alarm 2 Setpoint 1 Value	000B	011	FP	R/W	Within the range of selected parameter or PV span for deviation alarm
Alarm 2 Setpoint 2 Value	000C	012	FP	R/W	Within the range of selected parameter or PV span for deviation alarm
Alarm 1 Setpoint 1 Type	008C	140	INT	R/W	0 = None 1 = Input 1 2 = Input 2 3 = PV 4 = Deviation 5 = Output 6 = Alarm on Shed 7 = SP Event On 8 = SP Event Off 9 = Manual 10 = Remote Setpoint 11 = Failsafe 12 = PV Rate of Change 13 = Alarm on Digital Input 14 = Deviation based on SP2 15 = Loop Break Limit Controller 0 = None 1 = PV 2 = Deviation 3 = Shed
Alarm 1 Setpoint 2 Type	008E	142	INT	R/W	Same as 140
Alarm 2 Setpoint 1 Type	0090	144	INT	R/W	Same as 140
Alarm 2 Setpoint 2 Type	0092	146	INT	R/W	Same as 140

Table continued on next page

Table 3-23 Set-up Group – Alarms, continued

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Alarm 1 Setpoint 1 Event	008D	141	INT	R/W	0 = Low Alarm 1 = High Alarm
Alarm 1 Setpoint 2 Event	008F	143	INT	R/W	0 = Low Alarm 1 = High Alarm
Alarm 2 Setpoint 1 Event	0091	145	INT	R/W	0 = Low Alarm 1 = High Alarm
Alarm 2 Setpoint 2 Event	0093	147	INT	R/W	0 = Low Alarm 1 = High Alarm
Alarm Hysteresis	0029	041	FP	R/W	0.0 to 100% of output or span
Alarm Latching for Output 1	00C8	200	INT	R/W	0 = Non Latching 1 = Latching
Alarm States	00C9	201	INT	R/W	State = 0 = Not in Alarm State = 1 = In Alarm Bit 0 = Alarm 11 State Bit 1 = Alarm 12 State Bit 2 = Alarm 21 State Bit 3 = Alarm 22 State Event = 0 = Low Event = 1 = High Bit 4 = Alarm 11 Event Bit 5 = Alarm 12 Event Bit 6 = Alarm 21 Event Bit 7 = Alarm 22 Event
Alarm 1 Blocking	00CA	202	INT	R/W	0 = Disable 1 = Block Alarm 1 2 = Block Alarm 2 3 = Block Alarm 1 and Alarm 2

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