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User's Guide



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CN8200 SERIES
Communications & Options Guide

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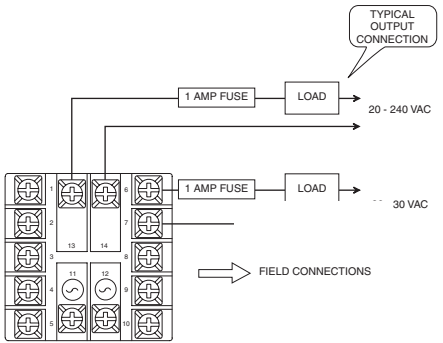
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Dual Alarm Outputs

Option -AL2: Dual Alarm Output, N.O.

This optional hardware module provides two alarm drive outputs. LED indicators A1 and A2 are used to indicate alarm conditions as configured in the Alarm Menu.



Option Description:

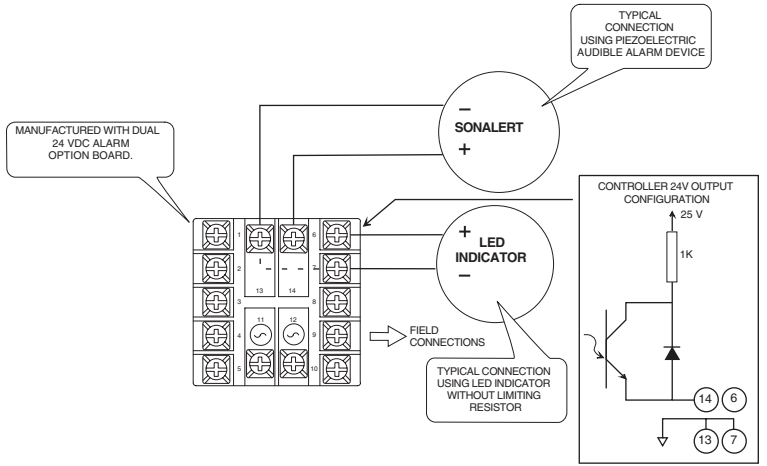
Option -AL2: Dual alarm, N.O.

Load Limits:

Max. Load Current	1 A rms
Min. Load Current	0.5 mA rms
Power Factor Range	0.2 to 1.0 (can drive small motors, solenoids, valves, and contactors)
Max. Surge Current	
Non-repeating for 1 second	7.5 A
Max. I^2T for fusing (0.01 sec)	4.5 amp-squared seconds (1 A - ABC1 typical fuse)

Dual 24 Vdc Alarm Outputs

Option -AL3: Dual 24 Vdc Alarm Outputs



Option Description:

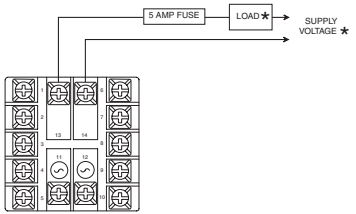
Dual 24 V outputs with clamping diodes
Pins 13 & 7 are connected internally
Source current is limited to 25 mA (1000 ohm resistor)
Open circuit voltage is 25 volts

Isolation:

Isolation 300 volts ac/dc either output to instrument

Relay, N.O. Alarm Output

Option -AL1: Relay, N.O. Alarm Output



Option Description: NO (Normally open) relay contact is closed when either alarm is active. Jumpers on the board can be removed to activate the output for a single alarm only:

JP1 - Alarm A1
JP2 - Alarm A2

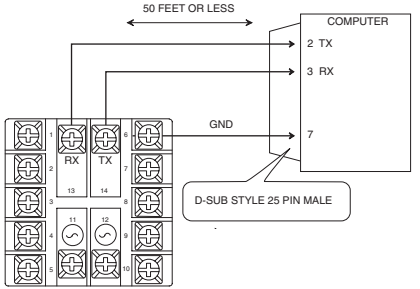
The relay life is greater than 100,000 operations at 5 operations per second switching full load.

*Connect load and supply voltage per the following table:

Load Type	5 Amp Voltage Limit
Resistive DC	30 Vdc
Inductive DC (L/R = 7 ms)	20 Vdc
Resistive AC	250 Vac
Inductive AC (pF = 0.4)	150 Vac
Motor, AC, 1/6 hp	250 Vac
Tungsten Lamp, 360 W	120 Vac

RS-232 Communications

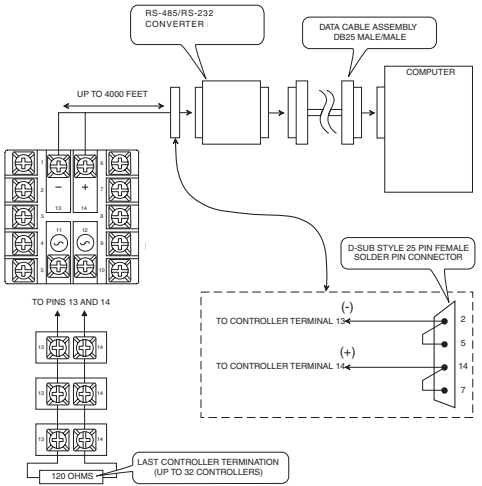
Option -C2: RS-232 (one-to-one) Communications



Option Description: Provides a one-to-one connection between the controller and an RS-232 port. Computers, PLCs, or dumb terminals may be used to set and access controller data.

RS-485 Communications

Option -C4: RS-485 (one-to-many) Communications



Option Description: Provides one-to-many communications.

If run exceeds 1000 ft., terminate the controller furthest from the computer by connecting a 120-ohm, 1/4-watt resistor between terminals 13 and 14.

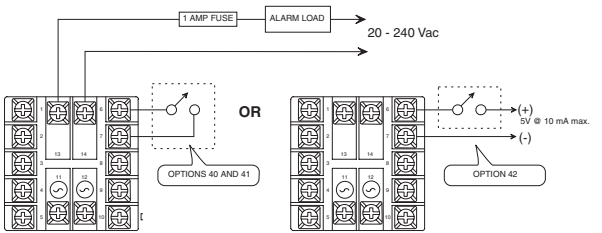
*Converter is supplied with a wallplug-mount power transformer.

Contact/Digital Input with Alarm

Options -RSP1, -RSP2, -RSP3 Remote Setpoint Switch, with Alarm (Contact Digital Input)

Input Option Menu

Display	Parameter	Selection	Default
C-d1	Func Function	dIS Switch Disabled	SSPS
		SSPS Second Setpoint Select	
		StbY Remote Standby	
		rSrH Ramp/Soak Run-Hold	



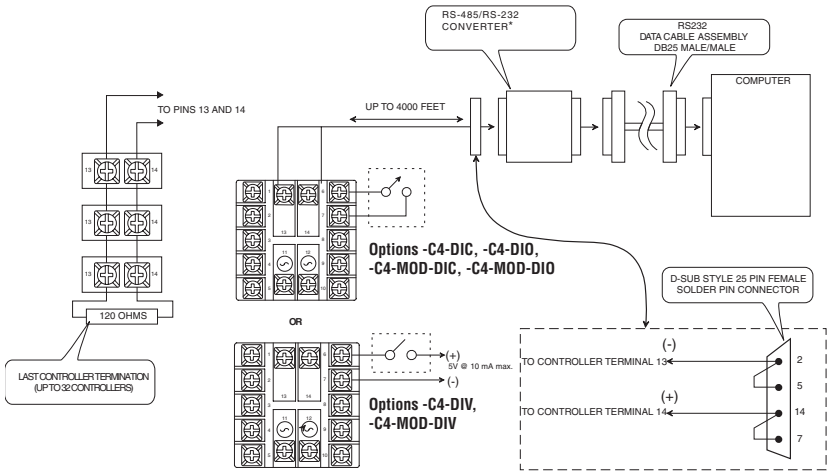
Option Description: Dual function board (functions unrelated)

a. Output alarm is energized when either A1 or A2 is active.

b. Digital input controls Remote Standby, Ramp-Soak Run/Hold, OR Second Setpoint Select.

RS-485 Communications

Options -C4-DIC, -C4-DIO, -C4-DIV, -C4-MOD, -C4-MOD-DIC, -C4-MOD-DIO, -C4-MOD-DIV: Digital Input plus RS-485 Communications



Note: See previous page for control input menu selections

Option Description: Provides one-to-many communications.

If run exceeds 1000 ft., terminate the controller furthest from the computer by connecting a 120-ohm, 1/4-watt resistor between terminals 13 and 14.

*Converter is supplied with a wallplug-mount power transformer.

Contact/Digital Input with Alarm

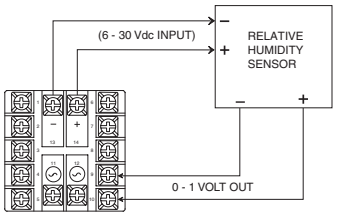
Option -RSP1: Active when switch closed.
Option -RSP2: Active when switch open.
Option -RSP3: Active when 5 V input present

Load Limits:

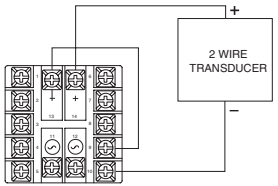
Max. Load Current:	1 A rms
Min. Load Current:	0.5 mA rms
Power Factor Range:	0.2 to 1.0 (can drive small motors, solenoids, valves, and contactors)
Max. Surge Current, Non-Repeating for 1 second:	7.5 A
Max. I^2T for fusing (0.01 sec):	4.5 amp-squared secs (1A - ABC1 typical fuse)

Transducer Excitation

Option -XP1, -XP2, -XP3, -XP4: Transducer Excitation



OR



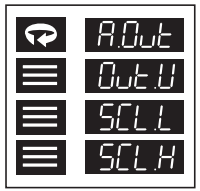
Option Description: The transducer excitation option provides power to remote transducers. The transducer outputs, in turn, provide a signal to the controller input which can be scaled in the appropriate engineering units.

Option -XP1: 15 Vdc
Option -XP2: 12 Vdc
Option -XP3: 10 Vdc
Option -XP4: 5 Vdc

All options will provide at least 20 mA. The transducer circuitry is thermally protected from short circuits.

Auxiliary Output

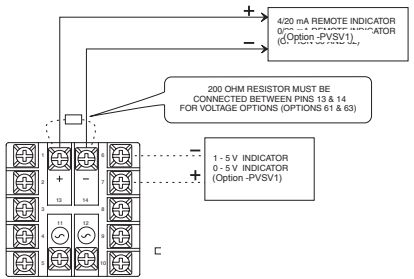
Option -PVSV1, -PVSV2: Process Output Option Menu



Display	Parameter	Selection	Default
Out.U	Variable	Proc Process Variable SP Setpoint Value	Process Variable
SCL.L	Low Scale	Full Scale	Sensor Low Scale (PV retransmit) Setpoint Low Scale (SV retransmit)
SCL.H	High Scale	Full Scale	Sensor High Scale (PV retransmit) Setpoint High Scale (SV retransmit)

Auxiliary Output

Option -PVSV1, -PVSV2: Auxiliary Output



Option Description: The Setpoint Variable or Process Variable is transmitted to a remote device (chart recorders, indicators, data recorders, computers, process controllers, etc.) with 1 of 4 different interfaces:
Option -PVSV1: 4-20 mA
Option -PVSV2: 0-5 V

The output signal is scalable in the Auxiliary Output Menu. Multiple remote indicators may be driven by the controller.

For current (mA) options, the remote indicators are connected in series. The sum of the input resistance for all remote indicators must be less than 400 ohms. For voltage options, the remote indicators are connected in parallel. The sum of the currents for all remote indicators must be less than 10 mA.

Digital Communications Option

Three remote communications options are available for the CN8200 which allow interfacing to remote devices utilizing the most common industry standards: RS232 and RS485.

Remote Communications Options

RS-232

This method allows bidirectional data transfer via a three-conductor cable consisting of signal ground, receive input and transmit output. It is recommended for communication distances less than 50 feet between the computer terminal and the instrument. Note: Multiple instruments cannot be connected to the same port.

The RS232 port is optically isolated to eliminate ground loop problems. Typically, “Data Out” of the computer/terminal connects to the “RCV” terminal. “Data In” connects to the “XMT” terminal. If shielded cable is used, it should be connected to the frame ground at one end only. Signal ground is to be connected at appropriate ground terminals (refer to wiring diagram on next page).

RS-485

The RS485 multipoint capability allows up to 32 controllers to be connected together in a half-duplex network or up to 100 controllers with an appropriate communications repeater.

Note: Call factory for a recommended RS485 converter.

This method allows bidirectional data transfer over a twisted pair cable. The twisted pair cable is a transmission line; therefore, terminating resistors are required at the most distant ends of the line to minimize reflections (typically 120 ohms at each end). The RS485 circuit is fully optically isolated, eliminating ground loop problems. Parallel drops from the transmission lines should be kept as short as possible; however, the line may be daisy-chained at each controller. The polarity of the line is important and each device will specify an "A" (+) and "B" (-) connection.

Figure 1a. Wiring diagram for RS-232 digital communications.

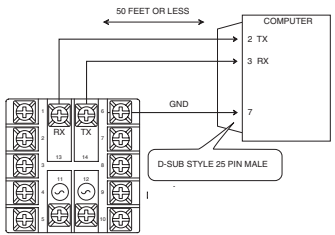
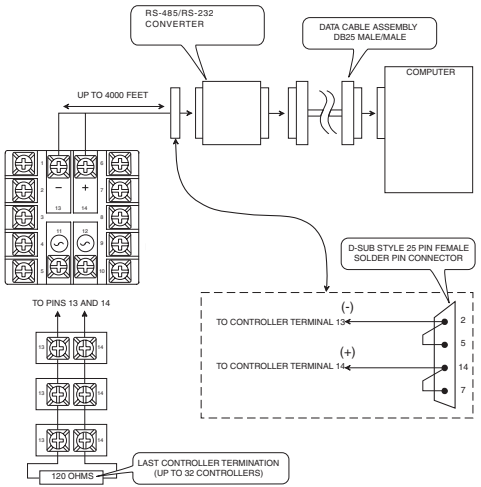


Figure 1b. Wiring diagram for RS-485 digital communications.



Digital
Communications
Option

Omega+ Protocol

The Omega+ Protocol provides an easy way to query and modify controller parameters using a personal computer and the optional digital communications option of the CN8200.

In this manual, the word "host" refers to the personal computer that's communicating with the controllers in the serial link, and the word "slave" refers to the controllers themselves.

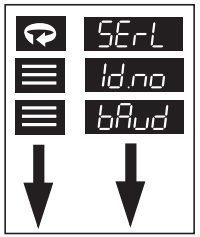
All transactions between the host and the slaves are done with messages consisting of only printable ASCII characters. There are only two primary types of messages: Requests and Responses. Messages coming from the host are called requests and messages coming from the slaves are called responses.

With the exception of a broadcast request, for every request sent from the host, the slave will send back a response. If a slave does not respond within 100 milliseconds, then the request can be considered lost.

A broadcast request is a request having an ID of '00' (see Message Formats on next page). It is used to address all slaves on the network. All slaves on the network will perform the actions requested in a broadcast message. However, a response message will not be returned. Therefore, the host can only broadcast Write or Auxiliary Command Requests. All slaves will ignore all Read Broadcast Requests.

Communications Option Menu

Omega+ Protocol (Standard)



Display	Parameter	Selection	Default
Id.no	Unit ID	1-255	1
bAud	Baud Rate	300 600 1200 2400 4800 9600	2400
dAt.F	Data Format Defined as 1 start bit / N# data bits / Parity odd, even, none / N# stop bits	7.0.1 7.E.1 7.n.2 7.0.2 7.E.2 8.n.1 8.0.1 8.E.1 8.n.2	8.n.1
tr dL	Transmit Delay	1-100ms	0

Digital Communications Option

Message Formats

All Omega+ messages adhere to the general format of:

[START CHAR][ID][ZONE][TYPE][PARAM][ERROR] [DATA][CHKSUM][END CHAR]

START CHAR

This is a single character which designates the start of the message. For a Request message, this character is the ASCII '$' and for a Response message, this character is the ASCII '%'.

ID

This is a two-character ID identifying the receiving controller. Controller IDs go from 1-255 inclusively and all slaves in the network must have unique IDs. The ID number of '00', when used in a request, designates a broadcast message that is used to address all controllers in the network. See the section Request Message for an explanation of the broadcast message.

In order to represent 255 with just two ASCII characters, a number system known as the Message Code Numbering System is used. In this system, the most significant digit is represented with the numbers 0-9 and the letters A-Z and the least significant digit is represented with the numbers 0-9.

The numbers 0-9 have the same values as their decimal counterparts and the letters A-Z have the values of 100 - 350 inclusively in increments of 10.

Example:

Message Code Value	=	Decimal Value
00		0 + 0 = 00
99		90 + 9 = 99
A0		100 + 0 = 100
A2		100 + 2 = 102
B8		110 + 8 = 118
P5		250 + 5 = 255

Zone

This is a two character ID identifying the Zone number in multi-zone capable controllers. For the CN8200, this number must be 01.

Digital
Communications
Option

Type

This is a single character identifying the type of message. The following table lists the type characters for all messages.

TYPE character	Message Type
R	Read Request or Read Response Returning a Positive Result
r	Read Response Returning a Negative Result
W	Write Positive Value Request and Response
w	Write Negative Value Request and Response
A	Auxiliary Command

For further information, see following sections on the different message types.

PARAM

This is a two character, message specific, parameter ID. For a Read/Write Request or Response message, this ID identifies the controller parameter. For an Auxiliary Command Request or Response message, this ID specifies the command.

STATUS

This is a single-character field used in all response messages, containing a status code specifying the status of the request message received.

DATA

This field contains the ASCII representation of the value of the parameter. For the Auxiliary Request or Response messages, this field either contains the ASCII representation of a numeric value or just ASCII data. The length of this field depends on the message type. The discussion on the specific message types gives the exact requirements for this field.

All ASCII representations of numeric values must be done using the characters '0'-'9', and '.'. Any use of other ASCII characters, including' ' and '-' will result in a bad message. Negative numbers **CANNOT** be represented by preceding the number with '-' character. Instead, a special message type is used. See subsequent sections for more information.

IMPORTANT: The data field in the Read and Write Request and Response messages must and will only contain the characters '0'-'9', and the decimal point '.'. All other characters are considered illegal. When the data field is listed as **Unused** or **Ignored** in an auxiliary command, it does not mean that the field can be skipped when sending in the request message. Instead, this field must be padded with any 10 alphanumeric (only letters and numbers are allowed) ASCII characters.

Examples of valid numeric representations for a 6 character data field:

Numeric Value	ASCII Representation
3	3.0000
	000003
	003.00
100	100.00
	0100.0
	000100
3.2	003.20
	0003.2

Examples of invalid numeric representations for 6 character data field: (B represents a blank, or a space, character)

Numeric Value	Bad ASCII Representation	Why?
3	BBBBB3	Leading blanks are not allowed.
	3.0BBBB	Trailing blanks are not allowed.
-3.2	-3.20000	'-' is not allowed.

CHKSUM

This is a two character Message Code Numbering System, representing the sum of all the ASCII values of all the characters (excluding the START, CHAR, the END CHAR, and the CHKSM themselves) in the message. The sum is computed using the following formula:

CHKSM = SUM(All Message Characters)%256

% represents the modulus operator.

END CHAR

This is a single character designating the end of the message. For all messages, the character used is <CR>, the carriage return.

Request Messages:

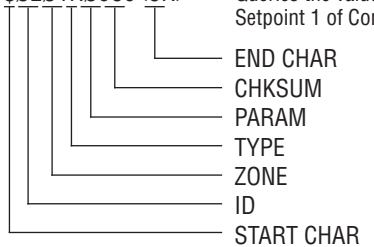
Request Messages are sent from the host to the slaves. Each request will have an ID identifying the intended recipient of the request. If the ID is '00' (zero), then the request is a broadcast message. All slaves will perform the action requested in the broadcast request. However, a response message will not be returned. Therefore, it only makes sense to send Write or Auxiliary Command Requests as broadcast requests. There are three types of Request Messages: Read, Write, and Auxiliary Commands.

The Read Request:

The Read Request is used to query parameter values and it has the following message format:
[START CHAR][ID][ZONE][TYPE][PARAM][CHKSUM][END CHAR]

Field Description: TYPE Must contain the uppercase letter 'R'.

Request Message	Description
$Ø1Ø1RØ5C1<CR>	Queries the value of the Process Variable of Controller #1.
$Ø1Ø1RØ9C5<CR>	Queries the value of the EEPROM Setpoint 1 of Controller #1
$Ø2Ø1RØ9C6<CR>	Queries the value of the EEPROM Setpoint 1 of Controller #2.



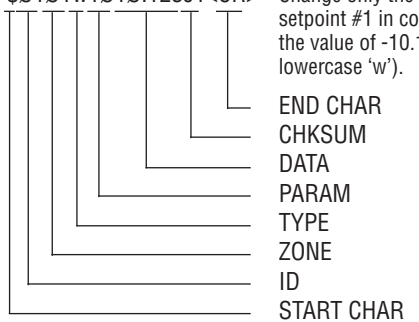
Examples of the responses to these requests are given in later sections on **Response Messages.**

The Write Request:

The Write Request is used to modify parameter values and it has the following message format: [START CHAR][ID][ZONE][TYPE][PARAM][DATA][CHKSUM][END CHAR]

Field Description: TYPE This field must contain one of the following two characters.
W– Value in DATA is a positive value.
w– Value in DATA is a negative value.
DATA A six-character ASCII representation of a numeric value.

Request Message	Description
$Ø1Ø1WØ91Ø.123G7<CR>	Change both the RAM and EEPROM copies of Setpoint #1 in controller #1 to the value of 10.123
$Ø1Ø1w1Ø1Ø.123J1<CR>	Change only the RAM copy of setpoint #1 in controller #1 to the value of -10.123 (notice the lowercase 'w').



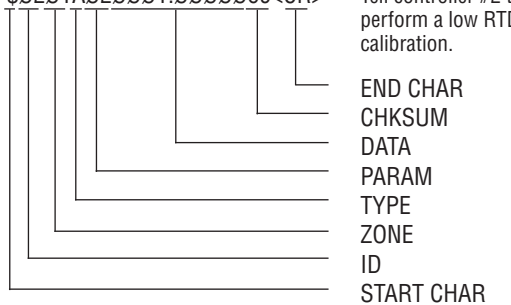
The Auxiliary Command Request:

The Auxiliary Command Request is used to issue commands to the controllers and it has the following message format:

Field Description: TYPE This field must contain the uppercase letter 'A'

DATA A ten-character ASCII representation of a numeric value or 10 alphanumeric ASCII characters.

Request Message	Description
$Ø1Ø1AØ1XXXXXXXXXL2<CR>	Tell controller #1 to load all parameters with their defaults. The 10 X's are padding characters.
$Ø2Ø1AØ2ØØØ1.ØØØØØ69<CR>	Tell controller #2 to perform a low RTD calibration.



Response Messages:

Response Messages are replies to the requests sent from the host. For each request received, the slave will reply back with a response.

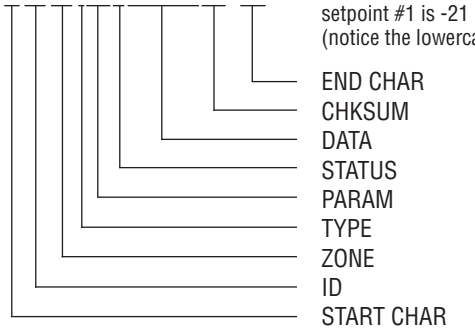
For all requests, the Omega+ Protocol specifies a maximum response time of 100 milliseconds. If a response is not received after 100 milliseconds, that request can be considered lost.

There are three types of Response Messages: Read, Write, and Auxiliary Commands.

The Read Response:

The Read Response will be sent in response to a Read Request. Some examples:

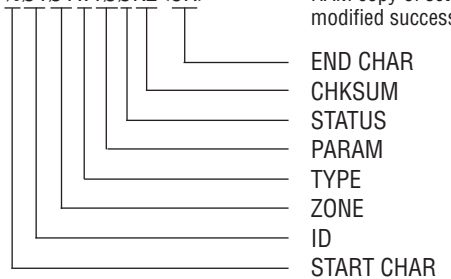
Request Message	Description
%Ø1Ø1RØ5Ø21.123K8<CR>	The value of the Process Variable is 21.123 Degrees C.
%Ø2Ø1R1Ø1G7<CR>	A serial transmission has occurred: Framing Error
%Ø1Ø1rØ9Ø21.ØØØN8<CR>	The value of the EEPROM setpoint #1 is -21 Degrees C (notice the lowercase 'r').



The Write Response:

The Write Response will be sent in response to a Write Request. Some examples:

Request Message	Description
%Ø1Ø1WØ93I1<CR>	A serial transmission error has occurred: Parity error. Write failed.
%Ø1Ø1w1ØØK2<CR>	RAM copy of setpoint #1 modified successfully.



The Auxiliary Command Response:

The Auxiliary Command Response will be sent in response to an Auxiliary Command Request.

Some examples are:

Request Message	Description
%Ø1Ø1AØ1ØXXXXXXXXXXØ4<CR>	Default load all parameters has started.
%Ø2Ø1AØ2ØØ.ØØØØØØØØB6<CR>	RTD low calibration on controller #2 has started.

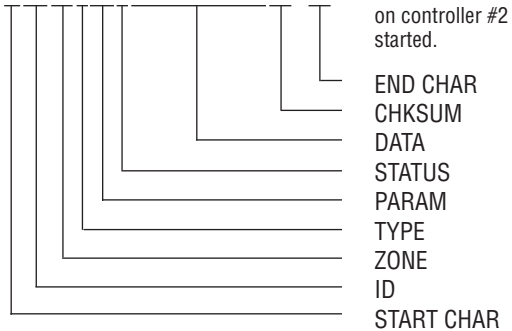


Table 1. Communications Parameter List (Omega+ Protocol)

Parameter Number	Description	Parameter Number	Description
1	Controller Type	19	Manual Control 2 Percentage
2	Software Version	2Ø	Output 1 Deadband
3	Communications Version	21	Output 1 Hysteresis
4	Status Byte	22	Output 1 Proportional Band
5	Process Value	23	Output 2 Proportional Band
6	Operating Mode	3Ø	Rate/Derivative Action
7	Access Level	32	Reset/Integral Action
8	Contact/Digital Input State	34	Manual Reset/ Internal Action
9	Setpoint - RAM, EEPROM	37	Output 2 Deadband
1Ø	Setpoint - RAM Only	38	Output 2 Hysteresis
11	Second Setpoint - RAM, EEPROM	39	Autotune Damping
12	Second Setpoint - RAM Only	4Ø	Recipe Option
13	Remote Analog Setpoint	41	Single Setpoint Ramp Time
14	Recipe Setpoint	42	Ramp Time 1
16	Output 1 Percentage	43	Ramp Time 2
17	Output 2 Percentage	44	Ramp Time 3
18	Manual Control 1 Percentage	45	Ramp Time 4
		46	Ramp Time 5
		47	Ramp Time 6
		48	Ramp Time 7

Table 1. Continued

Parameter Number	Description
49	Ramp Time 8
5Ø	Ramp Event 1
51	Ramp Event 2
52	Ramp Event 3
53	Ramp Event 4
54	Ramp Event 5
55	Ramp Event 6
56	Ramp Event 7
57	Ramp Event 8
58	Soak Level 1
59	Soak Level 2
6Ø	Soak Level 3
61	Soak Level 4
62	Soak Level 5
63	Soak Level 6
64	Soak Level 7
65	Soak Level 8
66	Soak Time 1
67	Soak Time 2
68	Soak Time 3
69	Soak Time 4
7Ø	Soak Time 5
71	Soak Time 6
72	Soak Time 7

Parameter Number	Description
73	Soak Time 8
74	Soak Event 1
75	Soak Event 2
76	Soak Event 3
77	Soak Event 4
78	Soak Event 5
79	Soak Event 6
8Ø	Soak Event 7
81	Soak Event 8
82	Recycle Number
83	Holdback Band
84	Termination State
85	Power Resume
86	Input Bias
87	Input Low Scale
88	Input High Scale
89	Lower Setpoint Limit
9Ø	Upper Setpoint Limit
91	Input Filter
92	Input Type
94	Output 1 Type
95	Output 1 Action
96	Output 1 Alarm Action

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Table 1. Continued

Parameter Number	Description
97	Output 1 Alarm Operation
98	Output 1 Alarm Delay
99	Output 1 Alarm Inhibit
AØ	Output 1 Process Alarm Setpoint
A1	Output 1 Deviation Alarm Setpoint
A2	Output 1 Cycle Time
A3	Output 1 Low Limit
A4	Output 1 High Limit
A5	Output 2 Type
A6	Output 2 Action
A7	Output 2 Alarm Action N/A
A8	Output 2 Alarm Operation
A9	Output 2 Alarm Delay N/A
BØ	Output 2 Alarm Inhibit
B1	Output 2 Process Alarm Setpoint
B2	Output 2 Deviation Alarm Setpoint
B3	Output 2 Cycle Time
B4	Output 2 Low Limit
B5	Output 2 High Limit

Parameter Number	Description
B6	TC/RTD Decimal Position
B7	Linear Decimal Position
B8	Display Filter
B9	Display Units
C1	Display Blanking
C2	Alarm 1 Action
C3	Alarm 1 Operation
C4	Alarm 1 Delay
C5	Alarm 1 Inhibit
C6	Alarm 1 Process Setpoint
C7	Alarm 1 Deviation Setpoint
C8	Alarm 2 Action
C9	Alarm 2 Operation
DØ	Alarm 2 Delay
D1	Alarm 2 Inhibit
D2	Alarm 2 Process Setpoint
D3	Alarm 2 Deviation Setpoint
D4	Communication Protocol
D5	Communication ID
D6	Communication Baud Rate
D7	Communication Data Format
D8	Communication Transmit Delay
E1	Output 1 Failsafe %
E2	Output 2 Failsafe %

Table 1. Continued

Parameter Number	Description
E3	Loop Break Time
E4	Highest Reading
E5	Lowest Reading
E8	Option Selection N/A
E9	TC Zero Calibration
FØ	TC Span Calibration
F1	RTD Zero Calibration
F2	RTD Span Calibration
F3	Low-Voltage Zero Calibration
F4	Low-Voltage Span Calibration
F5	High-Voltage Zero Calibration
F6	High-Voltage Span Calibration
F7	Current Zero Calibration
F8	Current Span Calibration
G1	Auxiliary Output Variable
G2	Auxiliary Output Scale Low
G3	Auxiliary Output Scale High
G5	RAS Scale Low
G6	RAS Scale High
G7	Contact/Digital Switch Function
H2	Autotune State
H3	Recipe State
H5	Current Recipe Segment
H6	Active Setpoint
H7	Resume Exhaustion Flag
F4	Low-Voltage Span
H8	LED Status Indicator
H9	RTD (with decimal support) Zero Calibration
IØ	RTD (with decimal support) Span Calibration

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Auxiliary Commands:

Command:	**Load Parameter Defaults**
Parameter #:	01
Description	Restore all menu parameters to their default values.
Request Data Field:	Ignored.
Response Data Field:	Ignored.
Command:	**Perform Process Low Calibration**
Parameter #:	02
Description:	Performs a Low Calibration. The data field in the request message specifies the process. Make sure the prerequisite for the calibration is satisfied before issuing a calibration command. For instance, the RTD calibration command must only be used when the input sensor type is chosen as RTD or RTD w/ Decimal.

Request Data Fields: A 10 character ASCII representation of a numeric value specifying what to calibrate.

0 - Thermocouple

1 - RTD, Resistive Thermal Device

2 - Linear

3 - RAS, Remote Analog Setpoint

Response Data Field: Ignored.

Command: **Perform Process High Calibration**

Parameter #: 03

Description: Performs a High Calibration. The data field in the request message specifies the process. Make sure the prerequisite for the calibration is satisfied before issuing a calibration command For instance, the RTD calibration command must only be used when the input sensor type is chosen as RTD or RTD w/ Decimal.

Request Data Field: A 10 character ASCII representation of a numeric value specifying what to calibrate.

0 - Thermocouple

1 - RTD, Resistive Thermal Device

2 - Linear

3 - RAS, Remote Analog Setpoint

Command: **Retrieve Display**

Parameter #: 05

Description: Retrieves the string currently displayed on the slave's display. The data field in the request message specifies which display and the data field in the response message contains the string.

Request Data Field: A 10 character ASCII representation of a numeric value specifying which display to retrieve data from.

0 - Lower Display

1 - Upper Display

Response Data Field: The ASCII string.

Command: **Clear Latched Alarms**

Parameter #: 10

Description: Clear all latched alarms.

Request Data Field: Ignored.

Response Data Field: Ignored.

Table 2. Communications Error Codes Returned.

Code	Description
0	No error.
1	Framing error.
2	Hardware error.
3	Parity error.
4	Bad character in the TYPE field.
5	Bad message. Message cannot be understood.
6	Bad checksum. The checksum received did not match the checksum of the message.
7	Bad zone ID.
8	Bad auxiliary command ID. The auxiliary command is not supported in this controller.
9	Bad parameter ID. The parameter is not supported in this controller.
A	Bad data. Bad representation in the data field or data is out of range.
B	Attempt to write to a read only parameter.
C	Cannot write to a parameter because it's in use.

Notes

Notes

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