COMMANDER 200
Process Controller

User Guide

Serial Data
Communications
Supplement

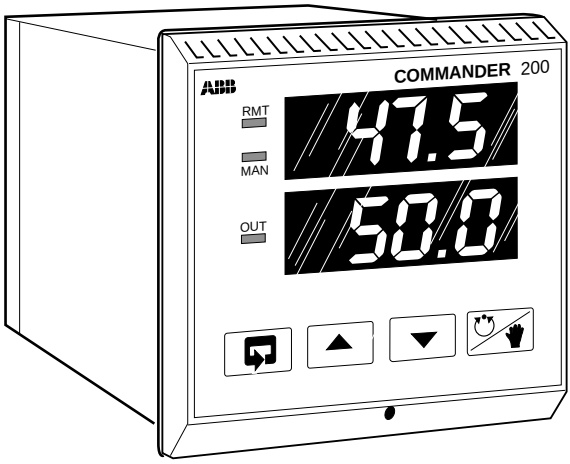

ABB Instrumentation

ABB INSTRUMENTATION

The Company

ABB Instrumentation is an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

The NAMAS Calibration Laboratory No. 0255 is just one of the ten flow calibration plants operated by the Company, and is indicative of ABB Instrumentation's dedication to quality and accuracy.

BS EN ISO 9001

St Neots, U.K. – Cert. No. Q5907
Stonehouse, U.K. – Cert. No. FM 21106

EN 29001 (ISO 9001)

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0255

Use of Instructions

Warning.
An instruction that draws attention to the risk of injury or death.

Note.
Clarification of an instruction or additional information.

Caution.
An instruction that draws attention to the risk of damage to the product, process or surroundings.

Information.
Further reference for more detailed information or technical details.

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.

Health and Safety
To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

CONTENTS

1 INTRODUCTION

The C200 Series of controllers is extended by the addition of a serial data communication option which allows addressing and reprogramming via a computer terminal or host computer.

The RS485 communication standard is used with the following logic levels:

a) for logic '1' (MARK condition or IDLE state) the 'A' terminal of the transmitter is negative (0V) with respect to the 'B' terminal (+5V)

b) for logic '0' (SPACE condition or ACTIVE state) the 'A' terminal of the transmitter is positive (+5V) with respect to the 'B' terminal (0V).

Parity is used for simple error checking. The parity bit is a one-bit code which is transmitted in addition to the ASCII character. It can detect only one error per character, since two errors may cancel out. Parity is calculated by finding the sum of logic '1's in the character and either:

a) setting the parity bit to logic '1' if the sum is odd, or logic '0' if the sum is even, when using even parity

or

b) setting the parity bit to logic '0' if the sum is odd, or logic '1' if the sum is even, when using odd parity.

The block check character (BCC) is an additional form of checking and is the arithmetic sum of all the characters in a complete message (excluding parity bits) – see Appendix A3. Error detection is achieved by comparison of the BCC's of the transmitted and received messages.

2 PREPARATION

The procedure is similar to that described in the Operating Instructions (IM/C200) with additions as detailed in this section.

2.1 Company Standard Settings

Only those parameters detailed on the customer order are programmed at the factory. If any parameters are unsuitable for the application they can be reprogrammed – see Section 7 of the Operating Instructions (IM/C200). Serial data programming details are to be found in Section 7 of this manual.

Standard parameter settings for the serial data programme are as follows:

Instrument Identity	01
Parity	odd parity
Block Check Character (BCC)	BCC on
Transmission Rate	9600 baud.

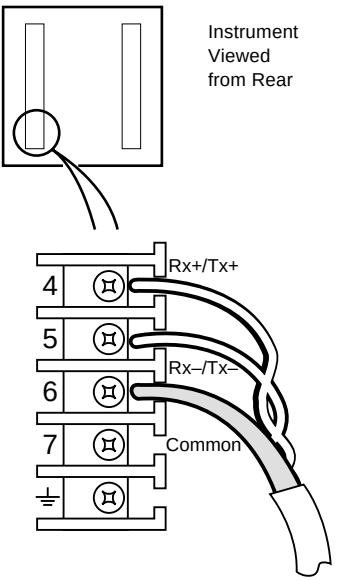


Fig. 4.1 Serial Connections

3 INSTALLATION

Observe the limitations outlined in the Operating Instructions (IM/C200). The maximum serial data transmission line length for the RS485 system is 1200m.

3.1 Serial Communication Adaptors for Personal Computers

An RS485 communications adaptor board is required for serial links. It is strongly recommended that the card used has galvanic isolation to protect the computer from lightning damage and increase immunity from noise pick-up from cables.

The adaptor card must have the provision for disabling the transmitter after each message is transmitted, so that bus contention does not occur. This is often implemented by the use of the RTS signal to control the transmitter enable. Consult the adaptor card manufacturer to determine suitability.

4 ELECTRICAL CONNECTIONS

All connections, apart from those for serial data communication, are made as shown in Table 4.2 in the Operating Instructions (IM/C200).

4.1 Serial Connections – Figs. 4.1 and 4.2

The controllers must be connected in parallel as shown in the schematic diagram – Fig. 4.2. The RS485 standard quotes connection of thirty two slaves (C200 Controllers) maximum to any single driver (computer terminal or host computer).

Make serial data connections as shown in Fig. 4.1. The type of cable used is dependent on the transmission speed and cable length:

Up to 6m (all speeds) – standard screened or twisted pair cable.

Up to 1200m – single twisted pair with foil screen and integral drain wire, e.g. Belden 9502 or equivalent.

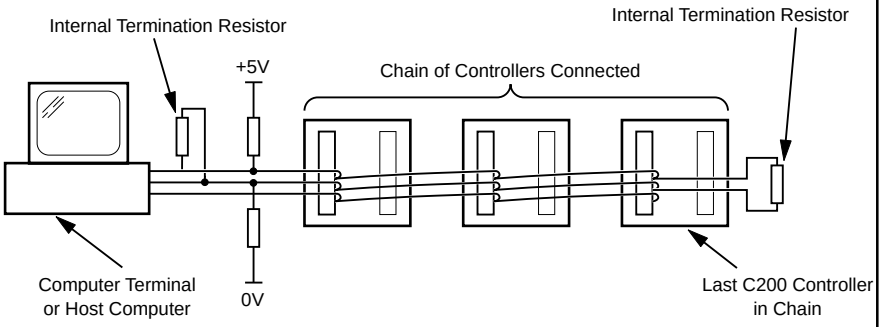


Fig. 4.2 Schematic Diagram

5 SETTING UP

For all aspects other than serial data transmission the controller is set up as shown in the Operating Instructions (IM/C200). Unless otherwise requested, the instrument is despatched with a transmission rate of 9600 baud and transmission line termination resistor linked-out. If the resistor is to be linked-in (see Fig. 4.2) carry out the following section.

5.1 Termination Resistor – Fig. 5.1

For long transmission lines, a termination resistor is required on the last C200 Controller in the chain and at the host computer/computer terminal – see Fig. 4.2. The controller's resistor is selected using plug-in link PL1 – see Fig. 5.1.

5.2 Pull-Up/Pull-Down Resistors – Fig. 5.1

Pull-up/pull-down resistors must be fitted to provide correct line biasing for idle line conditions, when no transmitters are enabled. These resistors are often fitted on the host adaptor card. If these resistors are not fitted on the host adaptor card , they can be fitted on the C200 serial board by positioning links PL2 and PL3 as shown in Fig. 5.1.

Switch off the supply and remove the controller from its case (Fig. 2.1 in the Operating Instructions, IM/C200). Set the termination resistor link as shown in Fig. 5.1. The protocol used is based on ANSI-X3.28-

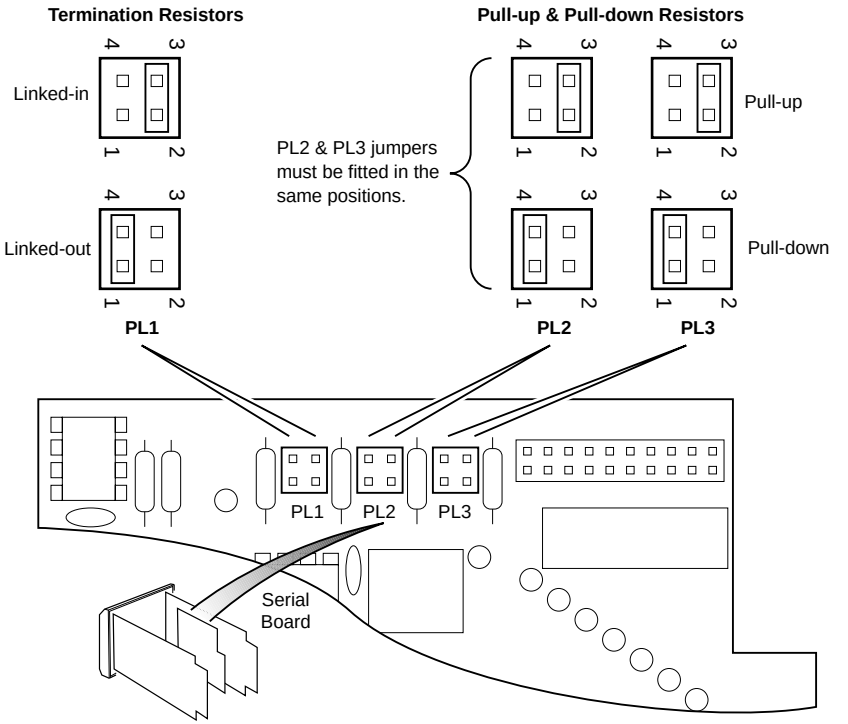


Fig. 5.1 Selecting the Termination Resistors

6 PROTOCOL

1976-2.S-A4 and is used for master (host computer) to slave (C200 Controller) systems. This is the **recommended protocol for use with supervisory systems** such as ABB Kent-Taylor PC30. The Protocol is:

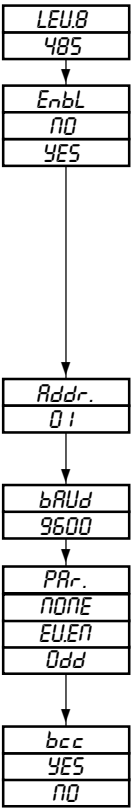
> Start transmission (STX) – Command – Identification … End transmission (ETX) – see Figs. 8.1 to 8.6.

Transmissions of commands and processing of the subsequent replies must be incorporated into the host computer programme.

7 PROGRAMMING

The general programming procedure is as detailed in the Operating Instructions (IM/C200).

7.1 Level 8 – RS485 Interface



Scroll to begin RS485 Interface Setup

Enable RS485
Scrolling when '*YES*' selects enable.
The enable/disable entry provides the means to disable the serial communications port and lock out the computer. When enabled, the communications task is started and operations can be implemented from the front panel or from a remote computer.
The instrument responds to the most recent command (either from the front panel controls or from a computer via the interface). When the port is disabled, operations can only be implemented from the front panel.

Address
Select instrument address (0 to 99) unique to a computer port.

Baud
Select baud rate (1200, 2400, 4800 or 9600).

Parity Enabled
'*NONE*' = no parity.
'*EU.EN*' = even parity.
'*Odd*' = odd parity.

Block Check Character (bcc)
'*NO*' disables bcc. '*YES*' enables bcc.
The block check character is a means of checking the integrity of the data transmitted over the interface. bcc is the bitwise exclusive OR of the Start-of-Text (STX), message, and End-of-Text (ETX) elements of the communications protocol.

8 COMMUNICATION

8.1 Communication Between Master and Slaves

The commands from the master are coded as single characters as follows:

R – 'Read' (read parameters)

M – 'Multiple Read' (read a selection of parameters)

W – 'Write' (write new parameter values).

8.1.1 Mnemonics

Each mnemonic for the C200 Controller parameters comprises two characters – see Section 8.6

8.2 Command Format – Figs. 8.1 to 8.3

The protocol is based on ANSI-X3.28-1976-2.5-A4. Entries are made directly from the host computer using the command format shown in Figs. 8.1 to 8.3.

8.2.1 Term Clarification for Command Format

Start – one ASCII control character (always 'STX') signifying the start of transmission.

Command – one character, R, M or W – see Section 8.1.

Instrument Identification – two characters identifying the C200 Controller, 01 to 99.

Parameter – two-character mnemonic selected from Section 8.6.

Sign – one character:

'+' – parameter value is positive (optional)

'–' – parameter value is negative.

Data – usually up to six characters (including decimal point) used to write a new parameter value.

Limiter – one character (always 'ETX') signifying the end of data transmission.

Block Check Character (BCC) – one character, the arithmetic sum of the complete message (excluding parity bits), transmitted by the host computer for error detection – see Appendix A3.

…8.2 Command Format

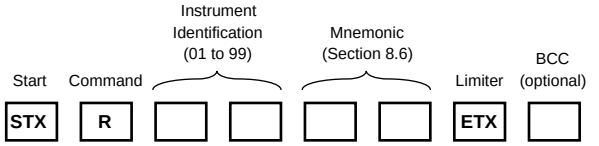


Fig. 8.1 'Read' Command Format

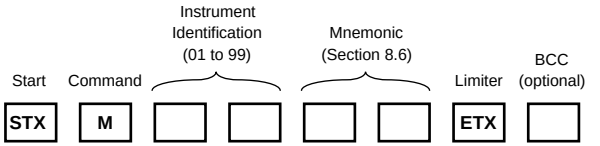


Fig. 8.2 'Multiple Read' Command Format

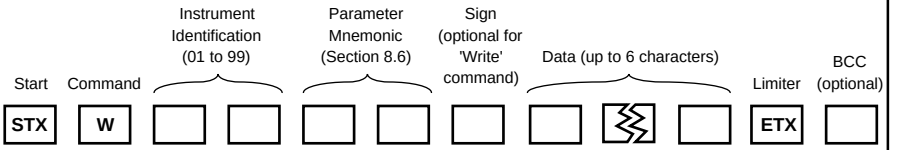


Fig. 8.3 'Write' Command Format

8.3 Reply Format – Figs 8.4 to 8.6

The C200 Controller replies to the command using the reply format shown in Figs. 8.4 to 8.6.

8.3.1 Term Clarification for Reply Format

Instrument Identification – two characters identifying the C200 Controller, 01 to 99.

Data – Up to six characters (including decimal point) showing the new parameter value

Error Code – two-character mnemonic – see Section 8.5.

Reply – one ASCII control character (see Appendix A2):

'ACK' – command understood
'NAK' – command not understood
'ETB' – end of multiple read reply block.

Block Check Character (BCC) – one character, the arithmetic sum of the complete message (excluding parity bits), transmitted by the controller for error detection – see Appendix A3.

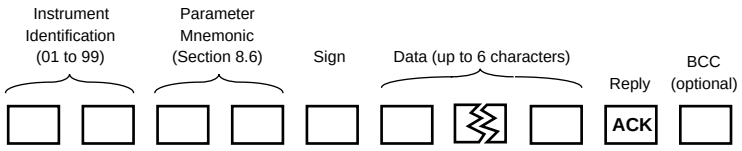


Fig. 8.4 Reply Format (Command Understood)

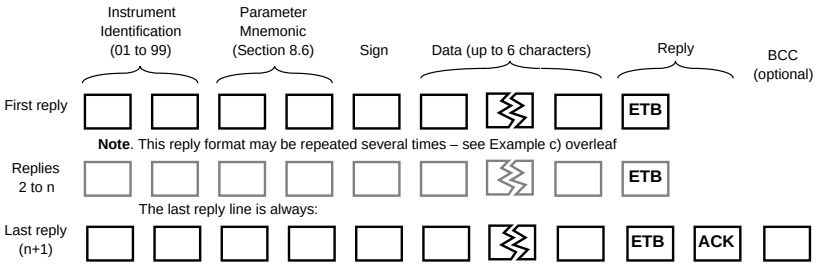


Fig. 8.5 Multiple Read Reply Format

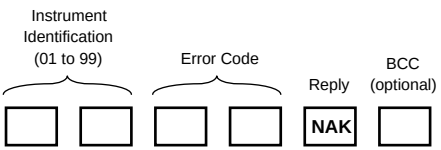


Fig. 8.6 Reply Format (Command Not Understood)

8.4 Communication Examples

The following examples show typical master-to-slave transmissions and the subsequent slave-to-master replies. For **Error Code** and **Parameter** interpretations refer to Sections 8.5 and 8.6.

a) Command – STX **R06PB** ETX

```
STX  R   06  PB  ETX
 |   |   |   |   |
 |   |   |   |   End of text
 |   |   |   Proportional band
 |   |   Controller number six
 |   'Read' command
 Start of text
```

Reply – **06PB100.0** ACK

```
06  PB  100.0 ACK
 |   |     |
 |   |     Command understood
 |   Proportional band is 100%
 Controller number 06
```

b) Command – STX **R07IX** ETX

```
STX  R   07  IX  ETX
 |   |   |   |   |
 |   |   |   |   End of text
 |   |   |   Parameter 'IX'
 |   |   Controller number seven
 |   'Read' command
 Start of text
```

Reply – **0702** NAK

```
07  02  NAK
 |   |    |
 |   |    Command not understood
 |   Error code 2
 Controller number seven
```

i.e. 'IX' in the original command is not a recognised 'Read' parameter – see Section 8.6.

c) Command – STX **M05 MG** ETX

```
STX  M   05  MG ETX
 |   |   |   |   |
 |   |   |   |   End of text
 |   |   |   Multiple read mnemonic
 |   |   Controller number five
 |   'Multiple Read' command
 Start of text
```

Reply:

```
Controller number 5
 |
 Command understood
 |
 |  05 MV 60.0 ETB    Measured value 60.0
 |  05 IS 17   ETB    Instrument status 17  *
 |  05 SP 65.0 ETB    Control setpoint 65.0
 |  05 OP 72.5 ETB ACK Control output 72.5%
 |                |
 |                End of transmission block
```

* This example shows the instrument status represented as the decimal number '17'. This number has been converted from the binary number '10001' (Process variable failure = failed, Alarm 2 relay state = on) – see Fig. 8.7.

d) Command – STX **M05MV** ETX

```
STX  M   05  MV  ETX
 |   |   |   |   |
 |   |   |   |   End of text
 |   |   |   Measured (process) Variable
 |   |   Controller number five
 |   'Multiple Read' command
 Start of text
```

Reply – **0519** NAK

```
05  19  NAK
 |   |    |
 |   |    Command  not understood
 |   Error code 19
 Controller number five
```

i.e. the 'Multiple Read' command cannot be used for a single parameter – see Section 8.6.

…8.4 Communication Examples

e) Command – STX **W1LA170** ETX

STX W 11 LA 70 ETX

- ETX — End of text
- 70 — Write **to** 70
- LA — Alarm A trip point
- 11 — Controller number eleven
- W — 'Write' command
- STX — Start of text

Reply – **11LA70** ACK

11 A1 70 ACK

- 70 — Command understood
- A1 — Alarm A setting is 70
- 11 — Controller number eleven

f) Command – STX **W05L21** ETX

STX W 05 L2 1 ETX

- ETX — End of text
- 1 — Relay 2 energised
- L2 — Relay 2 state
- 05 — Controller number five
- W — 'Write' command
- STX — Start of text

Reply – **0503** NAK

05 03 NAK

- 03 — Command not understood
- Error code 3
- 05 — Controller number five

i.e. 'L2' in the original command is not a recognised 'Write' parameter. The 'L2' mnemonic can only be used with the 'Read' command.

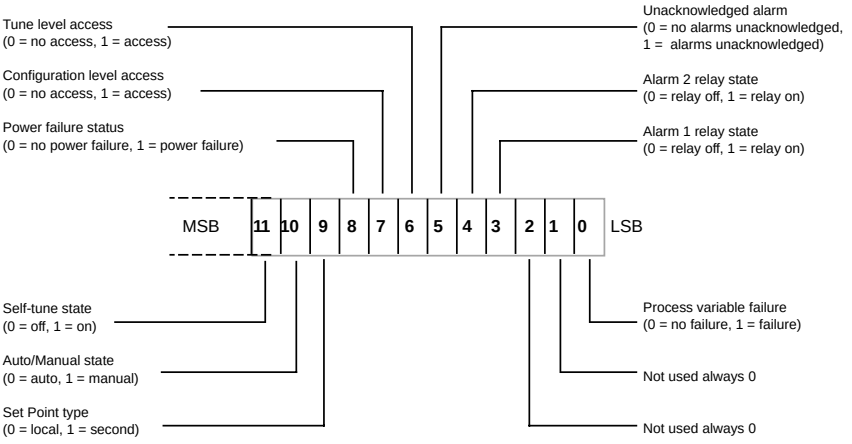


Fig. 8.7 Instrument Status

8.5 Error Codes

Error Code	Error
01	Invalid command – the received command was not R (read), W (write) or M (multiple read).
02	Invalid 'Read' parameter – parameter cannot be used with Read command.
03	Invalid 'Write' parameter – parameter cannot be used with Write command.
04	Too many characters entered into buffer – received message length is greater than 32 characters.
05	Invalid decimal point position.
08	The 'Write' value is not within the controllers limits.
10	Non-numeric character entered in data .
14	Output cannot be changed – the Control Output can only be changed when the controller is in Manual mode.
15	Received block check character error.
16	No STX character in complex format.
17	Received parity check error.
18	Overrun or framing error detected in received data.
19	Error in Multiple read command.
20	No data in 'Write' command.
21	More than one decimal point in data.
22	No data after decimal point in data.
23	More than six characters in data field.
24	Invalid characters in 'Read' command.

8.6 Command Mnemonics

8.6.1 General Parameters

Parameter	Mnemonic	Command		Reply Interpretation
		Read (R)	Write (W)	
Operating Parameters				
Measured Variab e	MV	Yes	No	Dependent on the programmed display range
Instrument Status	IS	Yes	No	Range 0 to 4095 – see Fig. 8.7 on page 10
Contro Set Point Value	SP	Yes	No	Any value within the programmed display range
Dua Set Point Va ue	DU	Yes	Yes	Any value within the programmed display range
Contro Output	OP	Yes	Yes	0.0 to 100.0 (%)
Manua Reset Va ue	MR	Yes	Yes	0.0 to 100.0 (%)
Auto/Manua State	AM	Yes	Yes	0 = AUTO 1 = MAN
Non-Vo ati e Save State	NV	Yes	Yes	0 = disable 1 = enable
Power Fai State/Acknowledge	PF	Yes	Yes	0 = Power failure acknowledge 1 = Power failure
Self-Tune Parameters				
Percentage Output	ZS	Yes	Yes	0.1 to 50.0 (%)
Step from Zero Hysteresis Value	SY	Yes	Yes	Any value within programmed display range
High Limit	TH	Yes	Yes	-999 to 9999
Low Limit	TL	Yes	Yes	-999 to 9999
Se f-tune Error State	TF	Yes	No	0 = No error/error acknowledged 2 = Input too noisy 3 = Timer overflow 4 = Self-tune limits exceeded 6 = Ratio of PV Amplitude/hysteresis < 4 7 = Proportional band or integral action time
Parameter Tune Selection	TM	Yes	Yes	0 = P and I 1 = P, I and D
Se f-tune Enab e	ST	Yes	Yes	0 = Self-tuning off 1 = Self-tuning on

…8.6.1 General Parameters

Parameter	Mnemonic	Command		Reply Interpretation
		Read (R)	Write (W)	
Control Page Parameters				
Cyc e Time	CT	Yes	Yes	1.0 to 300.0 seconds
Differentia Gap	HY	Yes	Yes	Any value within programme display range
Proportiona Band	PB	Yes	Yes	0.1 to 999.9
Integra Response	IT	Yes	Yes	0.1 to 120.0 rpt/min
Derivative Action Time	DT	Yes	Yes	1 to 999.9 seconds, 0 = OFF
Set Point Parameters				
Set Point High Limit	SH	Yes	Yes	Any value within the programmed display range
Set Point Low Limit	SL	Yes	Yes	Any value within the programmed display range
Loca Set Point	LP	Yes	Yes	Any value within the programmed display range
Set Point Tracking Enab e	TE	Yes	Yes	0 = No 1 = Yes
Dua Set Point High Limit	UH	Yes	Yes	Any value within the programmed display range
Dua Set Point Low Limit	UL	Yes	Yes	Any value within the programmed display range
Remote Set Point High Limit	MH	Yes	Yes	Any value within the programmed display range
Remote Set Point Low Limit	ML	Yes	Yes	Any value within the programmed display range
Ratio Adjust Va ue	RO	Yes	Yes	0.01 to 99.99
Bias Adjust Va ue	BO	Yes	Yes	–999 to +9999
Se ect Set Point Type	TY	Yes	Yes	0 = Local 2 = Second

8.6.1 General Parameters…

Parameter	Mnemonic	Command		Reply Interpretation
		Read (R)	Write (W)	
Set-up Process Variable Input Parameters				
Input Type	I1	Yes	Yes	0 = Volts 1 = mV 2 = TC 3 = rtd 4 = mA
Lineariser Type	W1	Yes	Yes	0 = J 1 = K 2 = E 3 = R 4 = S 5 = T 6 = B 7 = N
Lineariser Units	U1	Yes	Yes	0 = Degrees C 1 = Degrees F
Input High Va ue	S1	Yes	Yes	V = 0.1 to 5.00 mV = 10.0 to 150.0 mA = 5.00 to 20.00
Input Low Va ue	Z1	Yes	Yes	V = 0.0 to 4.90 mV = 0.0 to 140.0 mA = 4.00 to 19.00
Process Variab e Fau t Detect Level	1L	Yes	Yes	0 to 100.0
Recovery Option	1A	Yes	Yes	0 = Manual 1 = Last
Fau t Output	1O	Yes	Yes	0.0 to 100.0(%)
A.C. Source Frequency	MN	Yes	Yes	0 = 50Hz 1 = 60Hz

…8.6.1 General Parameters

Parameter	Mnemonic	Command		Reply Interpretation
		Read (R)	Write (W)	
Display Parameters				
Engineering Units High	DS	Yes	Yes	–999 to +9999
Disp ay Decima Point Position	DP	Yes	Yes	0 to 3 positions
Engineering Units Low	DZ	Yes	Yes	–999 to +9999
Set Up A arms Parameters				
A arm Type				0 = None
Alarm 1	YA	Yes	Yes	1 = High process
Alarm 2	YB	Yes	Yes	2 = Low process
Alarm 3	YC	Yes	Yes	3 = High deviation
Alarm 4	YD	Yes	Yes	4 = Low deviation
				5 = High output
				6 = Low output
Process A arm Trip Points				
Alarm 1	LA	Yes	Yes	–999 to +9999
Alarm 2	LB	Yes	Yes	
Alarm 3	LC	Yes	Yes	
Alarm 4	LD	Yes	Yes	

8.6.1 General Parameters

Parameter	Mnemonic	Command		Reply Interpretation
		Read (R)	Write (W)	
Set Up Alarms Parameters (continued)				
Process A arms Hysteresis Value				
Alarm 1	HA	Yes	Yes	In Engineering Units
Alarm 2	HB	Yes	Yes	
Alarm 3	HC	Yes	Yes	
Alarm 4	HD	Yes	Yes	
Process A arms Status				
Alarm 1	JA	Yes	No	0 = Inactive 1 = Active
Alarm 2	JB	Yes	No	
Alarm 3	JC	Yes	No	
Alarm 4				
Process A arms Acknowledged State				
Alarm 1	KA	Yes	Yes	0 = Acknowledged 1 = Unacknowledged
Alarm 2	KB	Yes	Yes	
Alarm 3	KC	Yes	Yes	
Alarm 4	KD	Yes	Yes	
A arm Acknow edge Enab e	EK	Yes	Yes	0 = None 1 = Normal 2 = Latch
Re ay B State	L2	Yes	No	As for Relay B State
Re ay C State	L3	Yes	No	As for Relay C State
Power – Up Mode	FM	Yes	Yes	0 = Last 1 = Manual 2 = Auto
Fixed Power – Up Output Va ue	FM	Yes	Yes	0 to 100.0%
Power – Up Message	PI	Yes	Yes	0 = No 1 = Yes
Contro Output High Limit	OH	Yes	Yes	0.0 to 100.0%
Contro Output Low Limit	OL	Yes	Yes	0 to 100.0%
Direct Acting	CA	Yes	Yes	0 = Reverse (No) 1 = Direct (Yes)

8.6.2 Multiple Read Parameters

Parameter Group	Mnemonic	Parameters
General Parameters	MG	Measured Value Instrument Status Control set Point Control Output
Control Parameters	CP	Proportional Band Integral Action Time Derivative Action Time Cycle Time Differential Gap
Channel 1 (Process Variable) Input Parameters	C1	Input Type TC Type Lineariser Units Range Full Scale Range Zero Fault Detect Level Default Action Default Output
Alarm Status	AS	Alarm 1 Alarm 2 Alarm 2 Alarm 4
Alarm Parameters	AA to AD	Alarm Type Alarm Trip Level Alarm HystserisisValue Alarm Status
Set Up Control Parameters	CS	Power Failure Mode Power Failure Output Power Failure Indication Enable Control Output High Limit Control Output Low Limit Control Action

9 OPERATION

Before attempting any serial communication, first ensure that the C200 Controllers connected to the computer terminal or host computer by serial link are functioning correctly as individual instruments. This is achieved by connecting all analogue inputs, applying the input signals and checking that the digital display reads appropriately.

Ensure that the serial data connections to C200 Controller have been made correctly with respect to the computer terminal, or host computer, interface. If the above check appears satisfactory, test the serial communication by sending an appropriate message from the computer terminal or host computer to a controller and observe if it replies; thus establishing communication. If communication is not established, check that the computer terminal, or host computer, interface is correctly set up and that the plug-in links within each controller are correctly positioned – see Section 5.

Check that the parameters programmed in the instrument's **Serial Data Communication Page** are compatible with those of the computer terminal or host computer – see Section 7.

If communication is still not possible or is erratic, check that the computer terminal, or host computer, interface has pull-up and pull-down resistors connected as shown in Fig. 9.1.

Note. If no reply is received from the instrument within 160ms, retransmit the command. If after five command re-entries a satisfactory reply has not been received, the communication link has been broken and must be rechecked

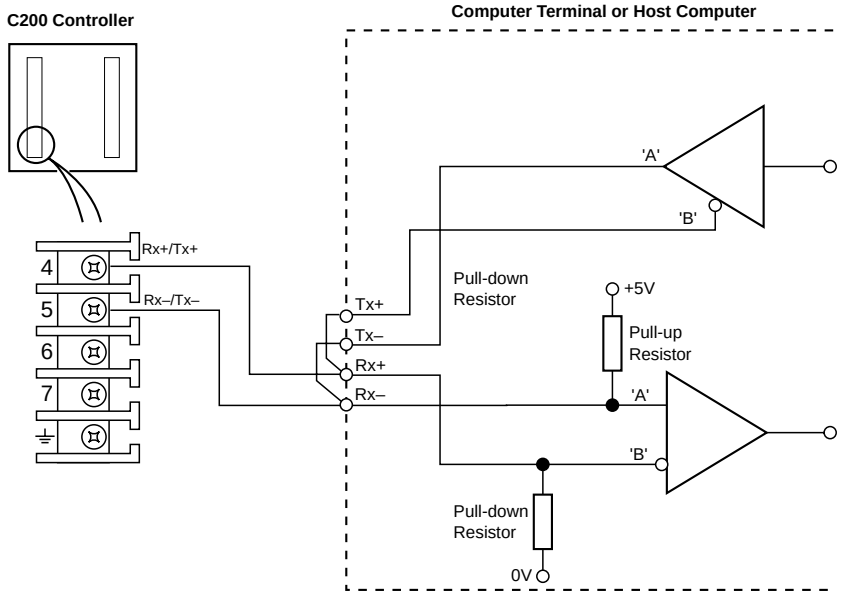


Fig. 9.1 Pull-up and Pull-down Resistors

10 SPECIFICATION

As detailed in the Operating Instructions (IM/C200), with the following additions:

EIA Communication Standard	RS485
Parity	None Odd Even
Block check character	Programmable on or off
Transmission line length	1200m max.
Transmission speeds	1200 baud 2400 baud 4800 baud 9600 baud — Programmable

APPENDICES

A1 The American Standard Code for Information Interchange (ASCII)

Character	Significance	Decimal	Hex.	Binary
NUL	Null, Operation	0	00	0000000
SOH	Start of Heading	1	01	0000001
STX	Start of Text	2	02	0000010
ETX	End of Text	3	03	0000011
EOT	End of Transmission	4	04	0000100
ENQ	Enquiry	5	05	0000101
ACK	Acknowledgement	6	06	0000110
BEL	Bell	7	07	0000111
BS	Backspace	8	08	0001000
HT	Horizontal Tabulation	9	09	0001001
LF	Line Feed	10	0A	0001010
VT	Vertical Tabulation	11	0B	0001011
FF	Form Feed	12	0C	0001100
CR	Carriage Return	13	0D	0001101
SO	Shift Out	14	0E	0001110
SI	Shift In	15	0F	0001111
DLE	Data Link Escape	16	10	0010000
DC1	Device Control 1	17	11	0010001
DC2	Device Control 2	18	12	0010010
DC3	Device Control 3	19	13	0010011
DC4	Device Control 4	20	14	0010100
NAK	Negative Acknowledge	21	15	0010101
SYN	Synchronous Idle	22	16	0010110
ETB	End of Transmission Block	23	17	0010111
CAN	Cancel	24	18	0011000
EM	End of Medium	25	19	0011001
SUB	Substitute Character	26	1A	0011010
ESC	Escape	27	1B	0011011
FS	File Separator	28	1C	0011100
GS	Group Separator	29	1D	0011101
RS	Record Separator	30	1E	0011110
US	Unit Separator	31	1F	0011111
SP	Space	32	20	0100000
!	.....	33	21	0100001
“	.....	34	22	0100010
#	Number detection	35	23	0100011
$	Other currency symbol	36	24	0100100
%	.....	37	25	0100101
&	.....	38	26	0100110
´	.....	39	27	0100111
(	.....	40	28	0101000
)	.....	41	29	0101001
✻	.....	42	2A	0101010
+	.....	43	2B	0101011
’	.....	44	2C	0101100
—	.....	45	2D	0101101
.	.....	46	2E	0101110
/	.....	47	2F	0101111

...A1 ASCII

Character	Significance	Decimal	Hex.	Binary
0	.....	48	30	0110000
1	.....	49	31	0110001
2	.....	50	32	0110010
3	.....	51	33	0110011
4	.....	52	34	0110100
5	.....	53	35	0110101
6	.....	54	36	0110110
7	.....	55	37	0110111
8	.....	56	38	0111000
9	.....	57	39	0111001
:	.....	58	3A	0111010
;	.....	59	3B	0111011
<	.....	60	3C	0111100
=	.....	61	3D	0111101
>	.....	62	3E	0111110
?	.....	63	3F	0111111
@	.....	64	40	1000000
A	.....	65	41	1000001
B	.....	66	42	1000010
C	.....	67	43	1000011
D	.....	68	44	1000100
E	.....	69	45	1000101
F	.....	70	46	1000110
G	.....	71	47	1000111
H	.....	72	48	1001000
I	.....	73	49	1001001
J	.....	74	4A	1001010
K	.....	75	4B	1001011
L	.....	76	4C	1001100
M	.....	77	4D	1001101
N	.....	78	4E	1001110
O	.....	79	4F	1001111
P	.....	80	50	1010000
Q	.....	81	51	1010001
R	.....	82	52	1010010
S	.....	83	53	1010011
T	.....	84	54	1010100
U	.....	85	55	1010101
V	.....	86	56	1010110
W	.....	87	57	1010111

A1 ASCII

Character	Significance	Decimal	Hex.	Binary
X	.....	88	58	1011000
Y	.....	89	59	1011001
Z	.....	90	5A	1011010
[	.....	91	5B	1011011
\	.....	92	5C	1011100
]	.....	93	5D	1011101
^	.....	94	5E	1011110
--	.....	95	5F	1011111
`	.....	96	60	1100000
a	.....	97	61	1100001
b	.....	98	62	1100010
c	.....	99	63	1100011
d	.....	100	64	1100100
e	.....	101	65	1100101
f	.....	102	66	1100110
g	.....	103	67	1100111
h	.....	104	68	1101000
i	.....	105	69	1101001
j	.....	106	6A	1101010
k	.....	107	6B	1101011
l	.....	108	6C	1101100
m	.....	109	6D	1101101
n	.....	110	6E	1101110
o	.....	111	6F	1101111
p	.....	112	70	1110000
q	.....	113	71	1110001
r	.....	114	72	1110010
s	.....	115	73	1110011
t	.....	116	74	1110100
u	.....	117	75	1110101
v	.....	118	76	1110110
w	.....	119	77	1110111
x	.....	120	78	1111000
y	.....	121	79	1111001
z	.....	122	7A	1111010
{	.....	123	7B	1111011
|	.....	124	7C	1111100
}	.....	125	7D	1111101
~	.....	126	7E	1111110
DEL	Delete	127	7F	1111111

A2 Non-volatile Memory Limitations

> **Note.** A non-volatile memory is used to store any parameter changes made via the serial link to ensure that the information is retained during mains interruption or power-down. The memory used is rated at 10^4 write cycles per register and each register is assigned a particular parameter, e.g. Alarm trip value. If the number of write cycles to any particular register exceeds this value, the register's contents may not be retained.

To restrict unnecessary use of the non-volatile memory registers the memory enable/disable command (NV) is provided. The command can be used before parameters which do not need to be stored in the non-volatile memory, e.g. frequently changed parameters or parameters which do not have to be retained on power-down.

A3 Block Check Characters

The block check character (BCC) transmitted is determined by the seven least significant bits in the binary arithmetic sum of a complete message (excluding parity bits). All characters transmitted before the BCC must be included in the arithmetic sum. Refer to Appendix A1 for ASCII characters.

A3.1 BCC Example

Message – STXR03LA–50ETX

Find the ASCII decimal equivalent of each character in the message, calculate the decimal arithmetic sum and hence obtain the binary arithmetic sum.

STX	= 2	Arithmetic sum = 473 decimal 111011001 binary
R	= 82	
0	= 48	
3	= 51	
L	= 76	
A	= 65	
–	= 45	
5	= 53	
0	= 48	
ETX	= 3	

Only the seven least significant bits (LSB) of the binary arithmetic sum are required to determine the BCC:

MSB LSB
11 1011001

'Y' is the BCC transmitted – see Appendix A3

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United Kingdom
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Client Warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification. Periodic checks must be made on the equipment's condition.

In the event of a failure under warranty, the following documentation must be provided as substantiation:

1. A listing evidencing process operation and alarm logs at time of failure.
2. Copies of operating and maintenance records relating to the alleged faulty unit.

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ABB Instrumentation Ltd
St. Neots
Cambs.
England, PE19 3EU
Tel: +44 (0) 1480 475321
Fax: +44 (0) 1480 217948

ABB Automation Inc.
Instrumentation Division
125 E. County Line Road
Warminster, PA 18974 USA
Tel: +1 215-674-6000
Fax: +1 215-674-7183

ABB Instrumentation SpA
22016 Lenno
Como
Italy
Tel: +39 (0) 344 58111
Fax: +39 (0) 344 58278