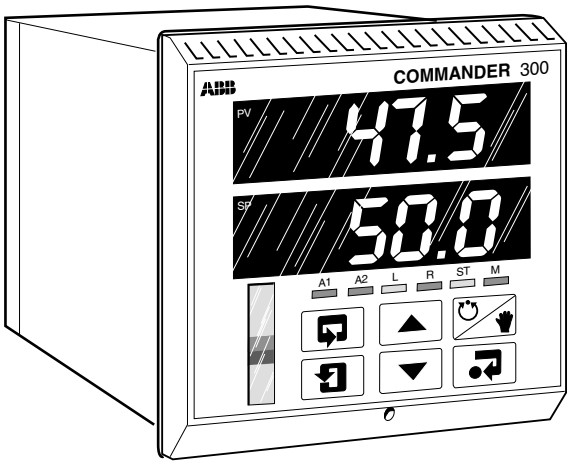
COMMANDER 300
Universal
Process Controller

Operating Instructions

Serial Data Communication
Supplement



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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.

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0255

Use of Instructions

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

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

Note.
Clarification of an instruction or additional information.

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.

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of Technical Communications Department, ABB Automation.

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 C300 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 RS422/485 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 on page 28. 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/C300) 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/C300). 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.

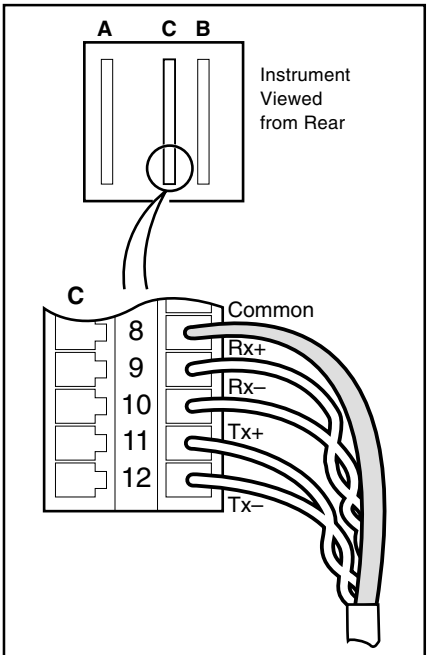


Fig. 4.1 Serial Connections

3 INSTALLATION

Observe the limitations outlined in the Operating Instructions (IM/C300). The maximum serial data transmission line length for both RS422 and RS485 systems is 1200m.

3.1 Serial Communication Adaptors for Personal Computers

An RS422/485 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 following OPTO22 boards are recommended for use with the C300 serial instruments.

Part No.	Computer Type
AC24	XT Bus IBM PC compatible
AC24 AT	AT Bus IBM PC compatible
AC34	Microchannel IBM PC.

The following'Jumper' selections are required on OPTO22 boards (usually supplied as the default configuration):

RX & TX install line termination jumper
Install pull-up and pull-down jumpers

CTS & RTS disable jumper installed.

Select board address and interrupts as described in the OPTO22 manual.

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/C300).

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 (C300 Controllers) maximum to any single driver (computer terminal or host computer); the RS422 standard quotes connection of up to ten slaves. However, these numbers can be increased if the driver's serial port permits.

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 300m – twin twisted pair with overall foil screen and an integral drain wire, e.g. Belden 9502 or equivalent

Up to 1200m – twin twisted pair with separate foil screens and integral drain wires for each pair, e.g. Belden 9729 or equivalent.

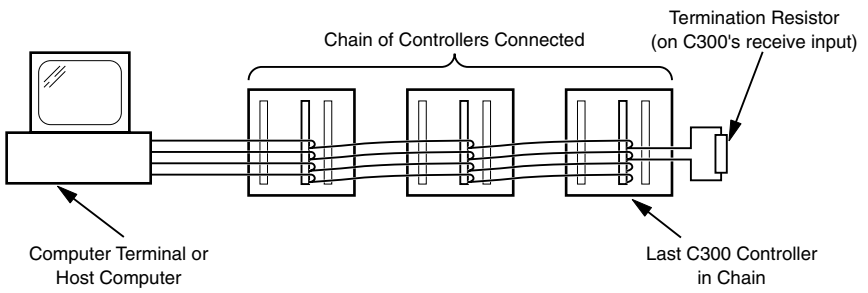


Fig. 4.2 Schematic Diagram

5 SETTING UP

For all aspects other than serial data transmission the controller is set up as shown in the Operating Instructions (IM/C300). Unless otherwise requested, the instrument is despatched with a transmission rate of 9600 baud and transmission line termination resistors linked-out. If the resistors are to be linked-in (see Fig. 4.2) carry out the following section.

5.1 Termination Resistors – Fig. 5.1

For long transmission lines, termination resistors are required on the last C300 Controller in the chain and at the host computer/computer terminal – see Fig. 4.2. Under normal operating conditions the resistors are required at the receive inputs only. The controller's resistors are selected using plug-in links – see Fig. 5.1.

Switch off the supply and remove the controller from its case (Fig. 2.1 in the Operating Instructions, IM/C300). Set the termination resistor links as shown in Fig. 5.1.

6 PROTOCOL

The protocol used is based on ANSI-X3.28-1976-2.5-A4 and is used for master (host computer) to slave (C300 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 on pages 7 and 8.

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

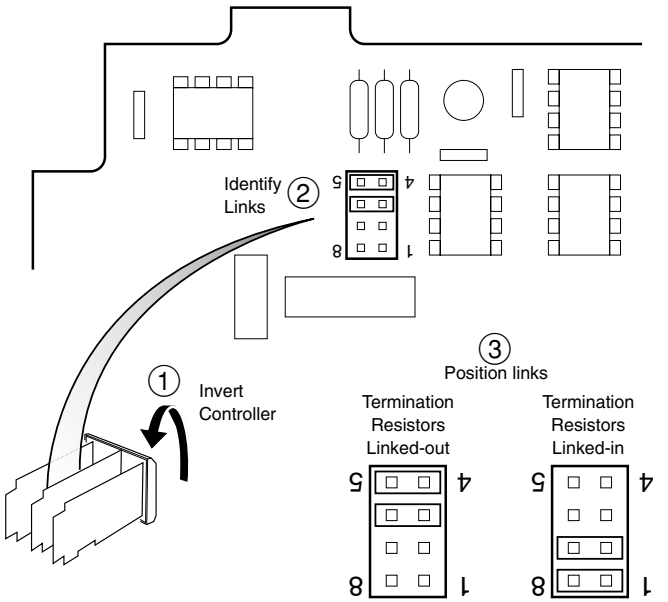


Fig. 5.1 Selecting the Termination Resistors

7 PROGRAMMING

The general programming procedure is as detailed in the Operating Instructions (IM/C300) but with an additional **Serial Data** page between the **Retransmission Output** and **Scale Adjustment** pages – see Fig. 7.1.

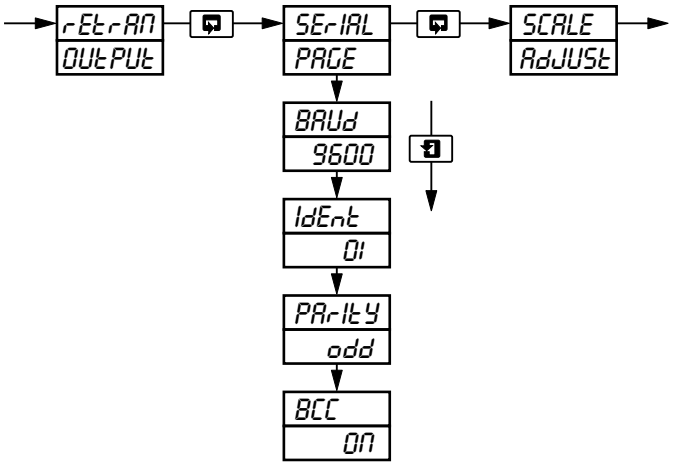
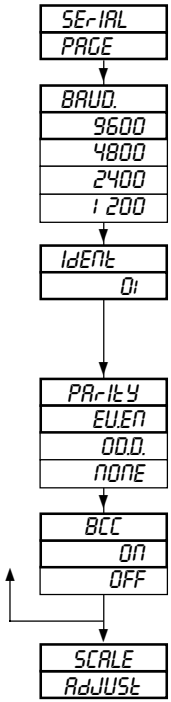


Fig. 7.1 Location of Serial Data Communication Page

7.1 Serial Data Communication Page



Page Header – **Serial Page.**

Transmission Rate
Select the retransmission rate required (1200 slowest, 9600 fastest).

Controller Identification
Assign the controller an identification number (01 to 99) – see Section 4.1 on page 3. The maximum number (99) allows controllers to be connected to more than one communication channel.

Parity
Select the appropriate parity to match the computer terminal or host computer.

Block Check Character
Select ON or OFF as required – see Section A3 on page 28.

Return to the top of the Serial Data Page or advance to the next page.

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 C300 Controller parameters comprises two characters – see Section 8.6.

8.1.2 Relay Logic Equation (Q1, Q2)

The alarm relay assignment is transmitted in the format in which it is displayed.

✶ **Note**. The terminator is transmitted as a '#', but appears on the display as 'Ξ'.

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 C300 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. However, up to 12 characters may be used if Alarm Relay Assignment is being carried out, i.e. using mnemonics Q1 and Q2.

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 on page 28.

…8.2 Command Format

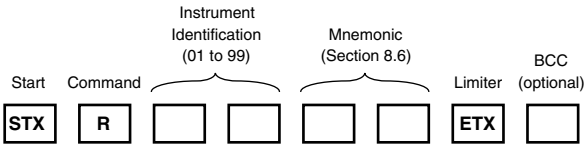


Fig. 8.1 'Read' Command Format

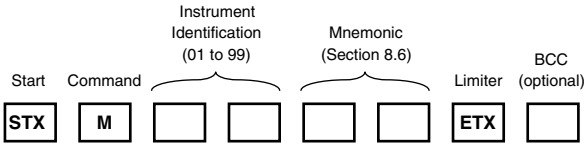


Fig. 8.2 'Multiple Read' Command Format

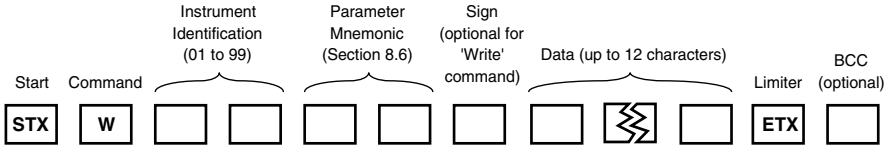


Fig. 8.3 'Write' Command Format

8.3 Reply Format – Figs 8.4 to 8.6

The C300 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 – usually up to six characters (including decimal point) showing the new parameter value.
However, up to 12 characters may be used if identifying the Alarm Relay Assignment, i.e. when using mnemonics Q1, Q2.

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

Reply – one ASCII control character (see Appendix A1):

'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 on page 28.

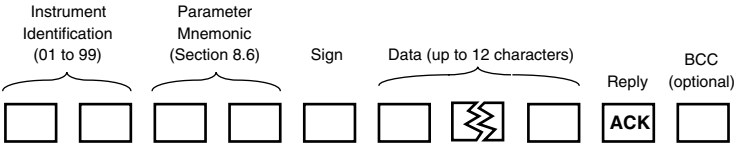


Fig. 8.4 Reply Format (Command Understood)

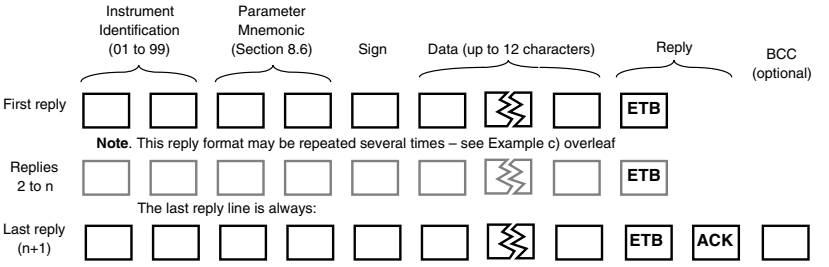


Fig. 8.5 Multiple Read Reply Format

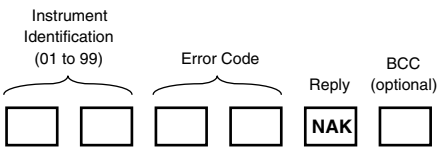


Fig. 8.6 Reply Format (Command Not Understood)

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 0 ETB         Instrument status 0 *
05 SP 65.0 ETB      Control setpoint 65.0
05 OP 72.5 ETB ACK  Control output 72.5%
                |
                End of transmission block
```

* '0' is the normal status – see Fig. 8.7 overleaf.

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 **W11A170** ETX

STX W 11 LA 70 ETX

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

Reply – **11LA70** ACK

11 A1 70 ACK

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

f) Command – STX **W05L21** ETX

STX W 05 L2 1 ETX

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

Reply – **0503** NAK

05 03 NAK

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

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

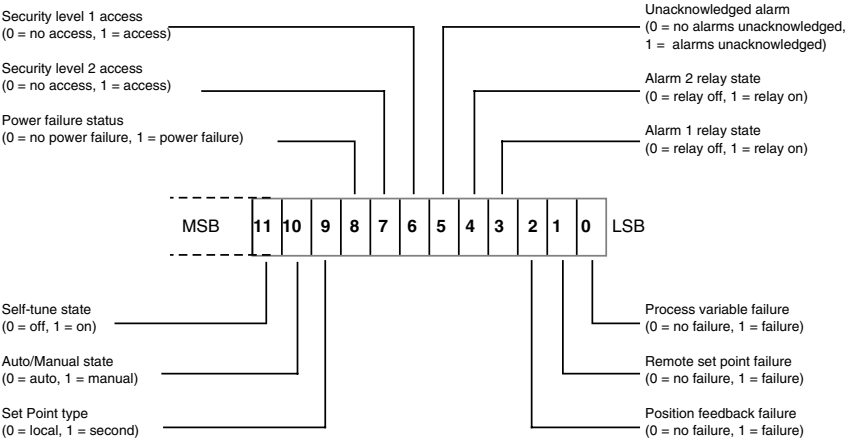


Fig. 8.7 Instrument Status

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 (12 for relay assignment) characters in data field.
25	Set point deviation alarm inputs > 4095 or < –4095.
26	Invalid characters in 'Read' command.
27	Error in 'Write' to logic equation.
28	Logic equation syntax error.

8.6 Command Mnemonics

8.6.1 General Parameters

Parameter	Mnemonic	Command		Reply Interpretation
		Read (R)	Write (W)	
Operating Parameters				
Measured Variable	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
Control Set Point Value	SP	Yes	No	Any value within the programmed display range
Remote Set Point Value	RP	Yes	No	Any value within the programmed display range
Dual Set Point Value	DU	Yes	Yes	Any value within the programmed display range
Control Output	OP	Yes	Yes	0 to 100.0 (%)
Manual Reset Value	MR	Yes	Yes	0.0 to 9.99 (%)
Actual Valve Position	VP	Yes	No	0.0 to 100.0 (%)
Auto/Manual State	AM	Yes	Yes	0 = AUTO 1 = MAN
Non-Volatile Save State	NV	Yes	Yes	0 = disable 1 = enable
Power Fail State/Acknowledge	PF	Yes	Yes	0 = Power failure acknowledge 1 = Power failure
Self-Tune Parameters				
Self-Tune Type	TT	Yes	Yes	0 = Start Up 1 = At Set Point
Percentage Output	ZS	Yes	Yes	0.0 to 100.0 (%)
Step from Zero Hysteresis Value	SY	Yes	Yes	0.1 to 10.0 (%)
High Limit	TH	Yes	Yes	Any value within the programmed display range
Low Limit	TL	Yes	Yes	Any value within the programmed display range
Self-tune Error State	TF	Yes	No	0 = No error/error acknowledged 1 = Process variable too close to set point 2 = Input too noisy 3 = Timer overflow 4 = Self-tune limits exceeded 5 = Maximum rate may not have been detected 6 = Ratio of PV Amplitude/hysteresis < 4 7 = Proportional band or integral action time
P.I.D. Control Terms	TM	Yes	Yes	0 = P only 1 = P and I 2 = P, I and D
Control Type	TC	Yes	Yes	0 = Type A 1 = Type B
Self-tune Enable	ST	Yes	Yes	0 = Self-tuning off 1 = Self-tuning on
Advisory Proportional Band	AP	Yes	No	0.1 to 999.9
Advisory Integral Time	AI	Yes	No	1 to 7200 seconds, 7201 = OFF 0 to 120 minutes, 121 = OFF
Advisory Derivative Time	AD	Yes	No	1 to 999.9 seconds, 0 = OFF 0.1 to 16.65 minutes, 0 = OFF
Self-tune Accept	SA	Yes	Yes	0 = Reject advisory values 1 = Accept advisory values

8.6.1 General Parameters…

Parameter	Mnemonic	Command		Reply Interpretation
		Read (R)	Write (W)	
Control Page Parameters				
Time Units	TU	Yes	Yes	0 = Seconds 1 = Minutes
Cycle Time	CT	Yes	Yes	1.0 to 300.0 seconds (0.9 = ON/OFF)
Hysteresis Value	HY	Yes	Yes	0.0 to 5.0(%)
Proportional Band	PB	Yes	Yes	0.1 to 999.9
Integral Action Time	IT	Yes	Yes	1 to 7200 seconds, 7201 = OFF
Derivative Action Time	DT	Yes	Yes	1 to 999.9 seconds, 0 = OFF
Approach Band	AB	Yes	Yes	0.1 to 3.0
P.I.D. Offset	OF	Yes	Yes	0 = 0.0 1 = 50.0
Set Point Parameters				
Local Set Point Adjust Enable	SE	Yes	Yes	0 = No 1 = Yes
Local Set Point High Limit	SH	Yes	Yes	Any value within the programmed display range
Local Set Point Low Limit	SL	Yes	Yes	Any value within the programmed display range
Local Set Point	LP	Yes	Yes	Any value within the programmed display range
Set Point Tracking Enable	TE	Yes	Yes	0 = No 1 = Yes
Set Point Type Select State	TS	Yes	Yes	0 = No 1 = Yes
Second Set Point State	UE	Yes	Yes	0 = None 1 = Dual 2 = Remote
Dual Set Point High Limit	UH	Yes	Yes	Any value within the programmed display range
Dual 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 Enable (Remote Set Point)	RE	Yes	Yes	0 = No 1 = Yes
Ratio Adjust Value (Remote Set Point)	RO	Yes	Yes	0.010 to 9.999
Bias Adjust Enable (Remote Set Point)	BE	Yes	Yes	0 = No 1 = Yes
Bias Adjust Value (Remote Set point)	BO	Yes	Yes	–100 to +100
Select Set Point Type	TY	Yes	Yes	0 = Local 1 = Balance 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 = mV 1 = mA 2 = Volts 3 = Ohms 4 = Thermocouple 5 = RTD
Lineariser Type	W1	Yes	Yes	0 = None 1 = Type K 2 = Type R 3 = Type S 4 = Type T 5 = Type J 6 = Type L 7 = Type N 8 = RTD 9 = SQRT 10 = 3/2 11 = 5/2
Linearisier Units	U1	Yes	Yes	0 = Degrees C 1 = Degrees F
Process Variable Linearisier Range Full Scale	X1	Yes	Yes	–420 to +3100
Process Variable Linearisier Range Zero	E1	Yes	Yes	–420 to +3100
Process Variable Range Full Scale	S1	Yes	Yes	–1999 to +1999
Process Variable Decimal Pt. Position	P1	Yes	Yes	0 to 2
Process Variable Range Zero	Z1	Yes	Yes	–1999 to +1999
Process Variable Broken Sensor Drive	BK	Yes	Yes	0 = None 1 = Up 2 = Down
Process Variable Fault Detect Level	1L	Yes	Yes	0 to 100.0
Process Variable Default Action	1A	Yes	Yes	0 = None 1 = Hold 2 = O/P
Process Variable Default Output	1O	Yes	Yes	0.0 to 100.0(%)
Process Variable Programmable Filter Time Constant	FC	Yes	Yes	0 to 60 (seconds)
Mains Frequency	MN	Yes	Yes	0 = 50Hz 1 = 60Hz

8.6.1 General Parameters…

Parameter	Mnemonic	Command		Reply Interpretation
		Read (R)	Write (W)	
Remote Set Point Set Up Parameters				
Remote Set Point Input Type	I2	Yes	Yes	0 = mV 1 = mA 2 = Volts 3 = Ohms 4 = Thermocouple 5 = RTD
Remote Set Point Lineariser Type	W2	Yes	Yes	As for Lineariser Type in Set-up Process Variable Input Parameters
Remote Set Point Lineariser Units	U2	Yes	Yes	0 = Degrees C 1 = Degrees F
Remote Set Point Lineariser Full Scale	X2	Yes	Yes	–420 to +3100
Remote Set Point Lineariser Range Zero	E2	Yes	Yes	–420 to +3100
Remote Set Point Range Full Scale	S2	Yes	Yes	–1999 to +1999
Remote Set Point Decimal Pt. Position	P2	Yes	Yes	0 to 2
Remote Set Point Range Zero	Z2	Yes	Yes	–1999 to +1999
Remote Set Point Fault Detect Level	2L	Yes	Yes	0 to 100.0
Remote Set Point Default Action	2A	Yes	Yes	0 = None 1 = Local 2 = Default Set point
Remote Set Point Default Set Point	2S	Yes	Yes	Any value within the programmed display range
Set-Up Position Feedback Parameters				
Position Feedback Input Type	I3	Yes	Yes	0 = mV 1 = mA 2 = Volts 3 = Ohms
Position Feedback Range Full Scale	S3	Yes	Yes	–1999 to +1999
Position Feedback Decimal Pt. Position	P3	Yes	Yes	0 to 2 positions
Position Feedback Range Zero	Z3	Yes	Yes	–1999 to +1999
Position Feedback Fault Detect Level	3L	Yes	Yes	0 to 100.0
Position Feedback Default Action	3A	Yes	Yes	0 = None 1 = Hold

…8.6.1 General Parameters

Parameter	Mnemonic	Command		Reply Interpretation
		Read (R)	Write (W)	
Display Parameters				
Display Full Scale	DS	Yes	Yes	–9999 to +9999
Display Decimal Point Position	DP	Yes	Yes	0 to 3 positions
Display Zero	DZ	Yes	Yes	–9999 to +9999
Display Units	UM	Yes	Yes	0 = None 1 = DEG C 2 = DEG F
Bar Graph %/Bar Value	GI	Yes	Yes	1 to 10(%)
Analogue Output Parameters				
Analogue Output Full Scale	AS	Yes	Yes	0.0 to 20.0mA
Analogue Output Zero	AZ	Yes	Yes	0.0 to 20.0mA
Set Up Alarms Parameters				
Relay 1 Action	R1	Yes	Yes	0 Negative 1 Positive
Relay 2 Action	R2	Yes	Yes	As for Relay 1 Action
Relay 3 Action	R3	Yes	Yes	As for Relay 1 Action
Relay 4 Action	R4	Yes	Yes	As for Relay 1 Action
Process Alarm Type				
Alarm A	YA	Yes	Yes	0 = None
Alarm B	YB	Yes	Yes	1 = High process
Alarm C	YC	Yes	Yes	2 = Low process
Alarm D	YD	Yes	Yes	3 = High deviation
Alarm E	YE	Yes	Yes	4 = Low deviation
Alarm F	YF	Yes	Yes	5 = High output
Alarm G	YG	Yes	Yes	6 = Low output
Alarm H	YH	Yes	Yes	7 = Fast rate
Alarm J	YJ	Yes	Yes	8 = Slow rate
Alarm K	YK	Yes	Yes	9 = Mode alarm
Process Alarm Trip Levels				
Alarm A	LA	Yes	Yes	0 = None
Alarm B	LB	Yes	Yes	1 = High process – Display range
Alarm C	LC	Yes	Yes	2 = Low process – Display range
Alarm D	LD	Yes	Yes	3 = High deviation – ±Display range
Alarm E	LE	Yes	Yes	4 = Low deviation – ±Display range
Alarm F	LF	Yes	Yes	5 = High output – 0.0 to 100.0%
Alarm G	LG	Yes	Yes	6 = Low output – 0.0 to 100.0%
Alarm H	LH	Yes	Yes	7 = Fast rate – 0.5 to 500.0
Alarm J	LJ	Yes	Yes	8 = Slow rate – 0.5 to 500.0
Alarm K	LK	Yes	Yes	9 = Mode alarm: 0 = Auto 1 = Manual 2 = Local set point 3 = Remote set point 4 = Process variable failure 5 = Remote set point failure 6 = Position feedback failure 7 = Any input failure

8.6.1 General Parameters…

Parameter	Mnemonic	Command		Reply Interpretation
		Read (R)	Write (W)	
Set Up Alarms Parameters (continued)				
Process Alarms Hysteresis Value				
Alarm A	HA	Yes	Yes	0.0 to 100.0% or Engineering Units (within the display span), depending on the Alarm Type
Alarm B	HB	Yes	Yes	
Alarm C	HC	Yes	Yes	
:	:	:	:	
:	:	:	:	
Alarm H	HH	Yes	Yes	
Alarm J	HJ	Yes	Yes	
Alarm K	HK	Yes	Yes	
Process Alarms Status				
Alarm A	JA	Yes	No	0 = Inactive/Acknowledged 1 = Active/Acknowledged 254 = Active/Unacknowledged 255 = Inactive/Unacknowledged
Alarm B	JB	Yes	No	
Alarm C	JC	Yes	No	
:	:	:	:	
:	:	:	:	
Alarm H	JH	Yes	No	
Alarm J	JJ	Yes	No	
Alarm K	JK	Yes	No	
Process Alarms Acknowledged State				
Alarm A	KA	Yes	Yes	0 = Acknowledged 1 = Unacknowledged
Alarm B	KB	Yes	Yes	
Alarm C	KC	Yes	Yes	
:	:	:	:	
:	:	:	:	
Alarm H	KH	Yes	Yes	
Alarm J	KJ	Yes	Yes	
Alarm K	KK	Yes	Yes	
Alarm Acknowledge Enable	EK	Yes	Yes	0 = None 1 = Normal 2 = Latch
Relay 1 State	L1	Yes	No	0 = Off 1 = On
Relay 2 State	L2	Yes	No	As for Relay 1 State
Relay 3 State	L3	Yes	No	As for Relay 1 State
Relay 4 State	L4	Yes	No	As for Relay 1 State
Relay 1 Logic Equation	Q1	Yes	Yes	See Section 8.1.2 on page 6
Relay 2 Logic Equation	Q2	Yes	Yes	See Section 8.1.2 on page 6
Relay 3 Logic Equation	Q3	Yes	Yes	See Section 8.1.2 on page 6
Relay 4 Logic Equation	Q4	Yes	Yes	See Section 8.1.2 on page 6
Relay 1 Logic Equation Syntax	Y1	Yes	No	0 = No Error (in equation 1)
Relay 2 Logic Equation Syntax	Y2	Yes	No	0 = No Error (in equation 2)
Relay 3 Logic Equation Syntax	Y3	Yes	No	0 = No Error (in equation 3)
Relay 4 Logic Equation Syntax	Y4	Yes	No	0 = No Error (in equation 4)
Rate Alarm Filter	RA	Yes	Yes	0 to 60 seconds

…8.6.1 General Parameters

Parameter	Mnemonic	Command		Reply Interpretation
		Read (R)	Write (W)	
Set Up Control Parameters				
Power Fail Mode	FM	Yes	Yes	0 = Last 1 = Manual 2 = Auto
Power Fail Output Auto-Manual	FO	Yes	Yes	0 to 100.0%
Power Fail Output Manual-Manual	FP	Yes	Yes	0 to 100.0% (–0.1 = last manual output)
Power Fail Indication Enable	PI	Yes	Yes	0 = No 1 = Yes
Power Fail Message	PM	Yes	Yes	0 = No 1 = Yes
Auto/Manual Switch Enable	ME	Yes	Yes	0 = No 1 = Yes
Control Output High Limit	OH	Yes	Yes	0 = Off 1 = On
Control Output Low Limit	OL	Yes	Yes	0 to 100.0%
Control Action	CA	Yes	Yes	0 to 100.0%
Logic Input 1 Type	N1	Yes	Yes	0 = None 1 = Auto/Manual 2 = Local/Remote 3 = Acknowledge 4 = Fixed Set Point 5 = Profile Start 6 = Profile Reset 7 = Profile Skip
Logic Input 2 Type	N2	Yes	Yes	
Logic Input 3 Type	N3	Yes	Yes	
Logic Input 4 Type	N4	Yes	Yes	
Logic Input 1 State	F1	Yes	No	0 = Open (5V) 1 = Closed (0V)
Logic Input 2 State	F2	Yes	No	0 = Open (5V) 1 = Closed (0V)
Logic Input 3 State	F3	Yes	No	0 = Open (5V) 1 = Closed (0V)
Logic Input 4 State	F4	Yes	No	0 = Open (5V) 1 = Closed (0V)
Configured O/P Value	CV	Yes	Yes	0.0 to 100.0 (–0.1 = LAST)
Fixed Set Point 1	1F	Yes	Yes	Engineering units
Fixed Set Point 2	2F	Yes	Yes	Engineering units
Position Feedback Parameters				
Ratio Value	Y1	Yes	Yes	0.10 to 9.99
Bias Value	Y2	Yes	Yes	–100 to +100
Deadband Value	RA	Yes	Yes	0.0 to 20.0(%)

8.6.2 Profile Parameters

Parameter	Mnemonic	Command		Reply Interpretation
		Read (R)	Write (W)	
Profile Parameters				
Profile Status	PS	Yes	No	0 = Stop 1 = Ramp 2 = Soak 3 = Not Used 4 = Countdown 5 = Operator Hold 6 = Not Used 7 = Manual Hold 8 = Holdback Hold 9 = End
Countdown Time	CD	Yes	No	Time (in Minutes)
Current Programme	PP	Yes	No	1 to 9
Current Segment	PG	Yes	No	0 to 30
Segment Time	PT	Yes	No	Time (in Minutes)
Prog. Repeat Count	PR	Yes	No	0 to 99 (100 = Always)
First Prog. Select	1P	Yes	Yes	1 to 9 (10 = None)
Second Prog. Select	2P	Yes	Yes	1 to 9 (10 = None)
Third Prog. Select	3P	Yes	Yes	1 to 9 (10 = None)
Fourth Prog. Select	4P	Yes	Yes	1 to 9 (10 = None)
Time Delay	TD	Yes	Yes	0.0 to 999.9 minutes
Profile Start	GP	Yes	Yes	1 = Start
Hold State	PH	Yes	No	Bit 0 = Operator Hold Bit 2 = Manual Mode Hold Bit 3 = Holdback Hold
Profile Reset	RT	Yes	Yes	1 = Reset Profile
Skip	PK	Yes	Yes	1 = Skip
Operator Hold	PO	Yes	Yes	1 = Operator Hold

8.6.3 Heat/Cool Parameters

Parameter	Mnemonic	Command		Reply Interpretation
		Read (R)	Write (W)	
Control Page Parameters (Heat/Cool)				
Cycle Time (Cool)	CC	Yes	Yes	1.0 to 300.0
Proportional Band (Cool)	L2	Yes	Yes	0.1 to 999.9
Integral Action Time (Cool)	L3	Yes	Yes	1 to 7200 (7201 = OFF)
Manual Reset (Cool)	L4	Yes	Yes	0.0 to 99.9
Crossover Output Value	Q1	Yes	Yes	0.0. to 100.0
Transition Bandwidth	Q2	Yes	Yes	0.0 to 100.0
Output Off Hysteresis	Q3	Yes	Yes	0.0 to 25.0
Heat Output High Limit	Q4	Yes	Yes	0.0. to 100.0
Cool Output High/Low Limit	Y1	Yes	Yes	0.0. to 100.0
Heat Output	Y2	Yes	No	0.0 to 100.0
Cool Output	Y3	Yes	No	0.0 to 100.0

8.6.4 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 Approach Band Cycle Time Hysteresis Value
Channel 1 (Process Variable) Input Parameters	C1	Input Type Linearisер Type Linearisер Units Linearisер Full Scale Linearisер Zero Range Full Scale Range Zero Broken Sensor Drive Fault Detect Level Default Action Default Output Filter Time Constant
Channel 2 (Remote Set Point) Input Parameters	C2	Input Type Linearisер Type Linearisер Units Linearisер Full Scale Linearisер Zero Range Full Scale Range Zero Broken Sensor Drive Fault Detect Level Default Action Default Output
Channel 3 (Position Feedback) Input Parameters	C3	Input Type Range Full Scale Range Zero Fault Detect Level Default Action
Alarm Status	AS	Alarm A Alarm B Alarm C Alarm D Alarm E Alarm F Alarm G Alarm H Alarm J Alarm K
Alarm Parameters	AA to AK	Alarm Type Alarm Trip Level Alarm Hysteresis Value Alarm Status

…8.6.4 Multiple Read Parameters

Parameter Group	Mnemonic	Parameters
Self-tune Parameters	ST	P.I.D. Control Terms Control Type Advisory Prop. Band Advisory Int. Action Time Advisory Derivative Action Time
Display Parameters	DP	Display Full Scale Display Zero Display Units
Local Set Point Parameters	LS	Local Set Point Value Local Set Point Adjust Enable Local Set Point High Limit Local Set Point Low Limit
Dual Set Point Parameters	DS	Dual Set Point Value Second Set Point State Dual Set Point High Limit Dual Set Point Low Limit
Remote Set Point Parameters	RS	Remote Set Point Value Second Set Point State Remote Set Point High Limit Remote Set Point Low Limit Ratio Adjust Enable Ratio Adjust Value Bias Adjust Enable Bias Adjust Value
Set Up Control Parameters	CS	Power Failure Mode Power Failure Output Auto/Manual Power Failure Output Manual/Manual Power Failure Indication Enable Power Failure Message Auto/Manual Switch Enable Control Output High Limit Control Output Low Limit Control Action

9 OPERATION

Before attempting any serial communication, first ensure that the C300 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 C300 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 on page 4.

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 on page 5.
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 – see above.

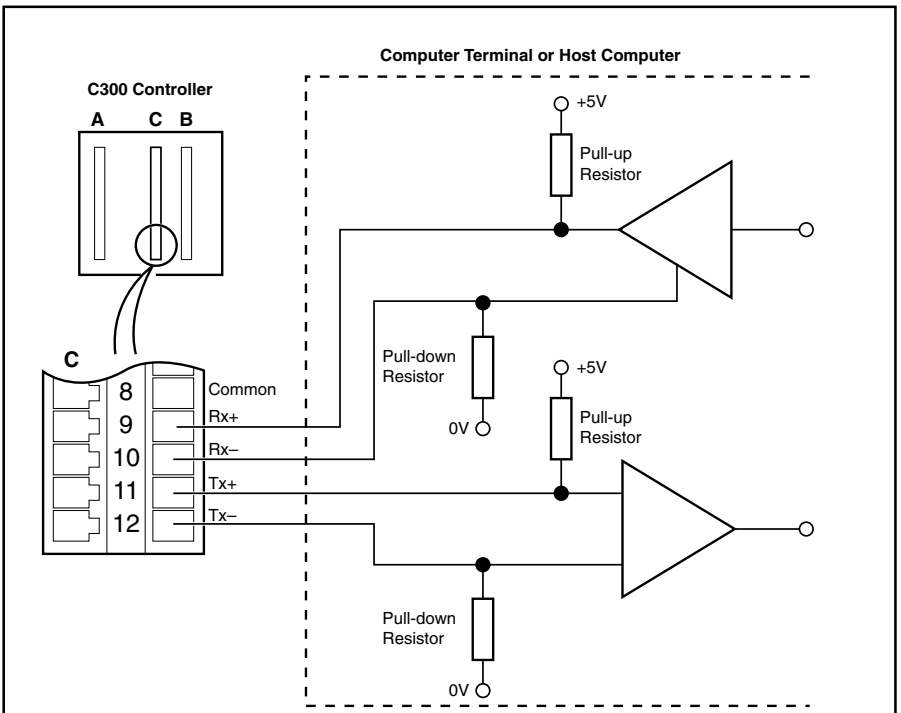


Fig. 9.1 Pull-up and Pull-down Resistors

10 SPECIFICATION

As detailed in the Operating Instructions (IM/C300), with the following additions:

EIA Communication Standards	RS422 and 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

…APPENDICES

…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

> ⚠ **Caution.** If the number of write cycles to any particular non-volatile memory register exceeds 10^4 cycles, the data stored may not be retained.

Any changes made to a parameter via the serial link, e.g. Control Set Point value, are stored in a non-volatile memory register assigned to that parameter.

The number of write cycles to a particular register can be reduced by disabling non-volatile memory access when making changes to parameters which do not need to be retained following a power-down. This is done using the **Non-volatile Save State** (NV) – see Section 8.6.1, General Parameters.

When the **Non-volatile Save State** is set to 'Enable', any parameter changes made via the serial link are written to non-volatile memory and are retained on power-down. If the **Non-volatile Save State** is set to 'Disable', parameter changes made via the serial link are not retained on power down.

The **Non-volatile Save State** must be adjusted only when necessary and must be reset to the required state each time the instrument is powered down, replaced with another instrument or the host computer is powered 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 on page 25 for ASCII characters.

A3.1 BCC Example

Message – STXW02MV–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 = 494 decimal 111101110 binary
R	= 82	
0	= 48	
2	= 50	
M	= 77	
V	= 86	
–	= 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 1101110

'n' is the BCC transmitted – see Appendix A1

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ABB Automation Inc.
Instrumentation Division
Tel: +1 215-674-6000
Fax: +1 215-674-7183

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.

IM/C300–SER Issue 4

The Company's policy is one of continuous product improvement and the right is reserved to modify the information contained herein without notice.

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