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CONTROLS

JBUS and MODBUS Digital Communications Handbook

900 SERIES INSTRUMENTS

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900 Series

JBUS and MODBUS Digital Communications Handbook

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900 SERIES JBUS AND MODBUS DIGITAL COMMS HANDBOOK

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Chapter 1 INTRODUCTION

This chapter describes the scope the JBUS and MODBUS handbook and how to use it.

Overview

This handbook is written for the people who need to use a digital communications link and JBUS or MODBUS communication protocols to supervise Eurotherm Controls instruments. The Eurotherm Controls 900 Series instruments covered by this handbook are; 902S, 902P, 903P, 904P and all 900EPC instruments (eg. 905S, 941D).

We have assumed that the reader has some experience of communication protocols and is familiar with the 900 Series instruments used on the communication network. Refer to the relevant instrument handbook for a full description of how to use the instruments, configuration options and a definition of parameters.

Chapter 2 of this document is a guide to cabling and the basic physical environment of digital communications.
Chapter 3 is a general description of the JBUS and MODBUS protocols.
Chapter 4 is a detailed description of the implementation of the protocols in the 902-4 Series instruments.
Chapter 5 describes the 900EPC Series implementation.
Appendix A is a Glossary of Terms.
Appendix B has a functional diagram of the 261 communication interface unit.

We have highlighted any feature of Eurotherm Controls products that is not a standard JBUS or MODBUS function.

Eurotherm Controls accepts no responsibility for any loss or damage caused by application of the information contained in this document.

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MODBUS® is a registered trademark of Gould Inc.

JBUS v MODBUS

- MODBUS is a serial communications protocol defined by Gould Inc.
  JBUS is a special case of MODBUS defined by APRIL.
- The two protocols use the same message frame format.
- The function codes used by 900 Series instruments are a subset of JBUS and MODBUS function codes.
- JBUS parameter addresses are equivalent to MODBUS addresses but incremented by 1. Subject to this simple address conversion a JBUS network can communicate with a MODBUS network or vice versa.
- In this document reference will be made to JBUS, however all information applies equally to MODBUS.

References

Refer to the documents below for further information;

Gould	MODBUS Protocol Reference Guide, PI-MBUS-300
APRIL	JBUS Specification
EIA Standard RS-232-C	Interface Between Terminal Equipment and Data Communication Equipment Employing Serial Binary Interchange
EIA Standard RS-422	Electrical Characteristics of Balanced Voltage Digital Interface Circuits
EIA Standard RS-485	Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multipoint Systems

Chapter 2 DIGITAL COMMUNICATIONS HARDWARE

This chapter defines the differences between the RS232, RS422 and RS485 digital communications standards. Details of configuration, cabling and termination will help to establish basic communications.

RS232, RS422 and RS485 Transmission standards

The Electrical Industries Association, (EIA) introduced the Recommended Standards, RS232, RS422 and RS485. These standards define the electrical performance of a communications network. The table below is a summary of the different physical link offered by the three standards.

EIA Standard	RS232C	RS422	RS485
Transmission mode	Single ended	Differential	Differential
Electrical connections	3 wire	5 wire	3 wire
No. of drivers and receivers per line	1driver, 1 receiver	10 driver, 10 receivers	32 driver, 32 receivers
Maximum data rate	20k bits/s	10M bits/s	10M bits/s
Maximum cable length	50ft, 15M	4000ft, 1200M	4000ft, 1200M

Note: RS232C has been abbreviated to RS232.

The RS232 standard allows a **single** instrument to be connected to a PC using a cable length of less than **15M**.

The RS422 and RS485 standards allow **one or more** instruments to be connected (muti-dropped) to a PC using a cable length of less than **1200M**. The balanced differential signal transmission is less prone to interference and should be used in preference to RS232 in noisy environments. RS422/RS485 is recommended for plant installation.

The 900 Series instruments provide an enhanced version of RS422 that meets the full electrical requirements of RS485 allowing up to 32 instruments to be connected on the same network, but only with a **5 wire** electrical connection. The transmission and reception of data use two pairs of twisted cable, with a separate cable provided for common. The optional screen will provide additional noise immunity.

Eurotherm Controls instruments use a terminal marking that is different to that used in the RS422/RS485 standards. The table below compares this marking.

RS422/RS485	Eurotherm
A'	RX+
B'	RX-
A	TX+
B	TX-
C & C'	Common

Using RS232 or RS422/485, the 900 Series instruments operate in a half duplex mode that does not allow the simultaneous transmission and reception of data. Data is passed by an alternating exchange.

Selection between RS232 and RS422/RS485 is by a hardware link within the instrument. The rear terminal connections must be wired to suit the selected transmission standard.

Most PC's provide an RS232 port for digital communications. The Eurotherm Controls 261 RS232/RS422 Universal Serial Interface unit is recommended for interfacing to RS422/485. This unit is also used to buffer an RS422/485 network when it is required to communicate with more than 32 instruments on the same bus. Even with RS232 this interface offers a buffer to isolate the PC from the harsh industrial environment of the instruments. Refer to Appendix B for a functional diagram of the 261.

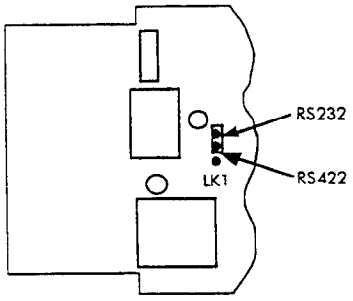
Selecting RS232 or RS422/485

For 902-4 Series instruments it is expensive to convert an instrument in the field to support digital communications. Ensure the initial order includes either RS232 or RS422/485 digital communications, (it is a simple task to convert between the two standards).

900EPC Series instruments are fitted with RS232 or RS422/485 digital communications as standard.

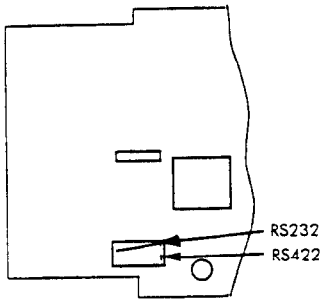
For all 900 series instruments digital communications can be configured to function in either RS232 or RS422/485 mode by changing a link switch mounted on the rear of a printed circuit board.

Power Supply Board



900 EPC link for RS232/RS422

Microprocessor Board



902-904 link for RS232/RS422

Cable selection

The cable selected for the digital communications network should have the following electrical characteristics:

- Less than 100 ohm / km nominal dc resistance. Typically 24 AWG or thicker.
- Nominal characteristic impedance at 100 kHz of 100 ohms.
- Less than 60 pF / m mutual pair capacitance, (the capacitance between two wires in a pair).
- Less than 120 pF / m stray capacitance, (the capacitance between one wire and all others connected to earth).
- For RS422/485 applications, use twisted pair cables.

The selection of a cable is a trade between cost and quality factors such as attenuation and the effectiveness of screening. For applications in an environment where high levels of electrical noise are likely, use a cable with a copper braid screen, (connect the screen to a noise free earth). For applications communicating over longer distances, choose a cable that also has good attenuation characteristics. As cables for communications are normally constructed with twisted pairs, providing a screened common connection will result in a redundant wire. (3 twisted pairs are needed for RS422/485 and 2 twisted pairs are needed for RS232.)

To overcome this restriction it is normal to use the earthed screen as the common connection. Connect the common to the earthed screen via a 120 ohm, 1/4W carbon composition resistor at the PC and all instruments. These resistors will reduce circulating ground currents.

For RS422/485 in low noise applications and over short distances it may be possible to operate the system with unscreened twisted data pairs. Earth is used as the common connection. Connect the common to earth via a 120 ohm, 1/4W carbon composition resistor at the PC and all instruments. This system is not recommended.

The following are a selection of cables suitable for RS 232 communication systems listed with decreasing quality;

Part number			Description
Alpha	Belden	BICC	
	8102	BE56332	2 twisted pairs with foil screen plus a 65% coverage copper screen*
5472	9502	H8086	2 twisted pairs with foil screen*
2403	8771	H8101	3 separate wires with foil screen*
	8761	H8082	1 twisted pair with foil screen

The following are a selection of cables suitable for RS 422/485 communication systems listed with decreasing quality;

Part number			Description
Alpha	Belden	BICC	
	9842		2 twisted pairs with foil screen plus a 90% coverage copper screen*
	9843		3 twisted pairs with foil screen plus a 90% coverage copper screen*
	9829		2 twisted pairs with foil screen plus a 90% coverage copper screen
	9830		3 twisted pairs with foil screen plus a 90% coverage copper screen
	8102	BE56332	2 twisted pairs with foil screen plus a 65% coverage copper screen
	8103	BE56333	3 twisted pairs with foil screen plus a 65% coverage copper screen
	9729	H9002	2 twisted pairs with foil screen
	9730	H9003	3 twisted pairs with foil screen

Cables marked are suitable for use with the wiring descriptions used in this chapter.
Cables marked '*' use a different colour coding to that used in the wiring descriptions.

Earthing

Ensure all earth points are noise free.

To reduce interference from external electrical signals, earth the cable screen at a single earth point. There must not be multiple earth paths in a single cable run. When using a Eurotherm Controls 261, RS232/RS422 Universal Serial Interface unit, do not connect the screen from one side of the interface to the other. Rather, earth each of the cables separately at a local earth point.

The digital communication outputs of all 900 Series instruments are isolated. To avoid common mode noise problems, connect the common line to earth at one point through a 100 ohm, 1/4W, carbon composition resistor. The resistor will limit the ground current.

Wiring general

Route communications cables in separate trunking to power cables. Power cables are those connecting power to instruments, relay or triac ac supplies and wiring associated with external switching devices such as contactors, relays or motor speed drives.

Communication cables may be routed with control signal cables if these signal cables are not exposed to an interference source. Control signals are the analogue or logic inputs and analogue or logic outputs of any control instrument.

Do not use redundant wires in the communications cable for other signals.

Cable runs must have sufficient slack to ensure that movement does not cause abrasion of the insulating sheath. Do not over tighten cable clamps to avoid accidental multiple earthing of the screen conductors.

Wiring RS232

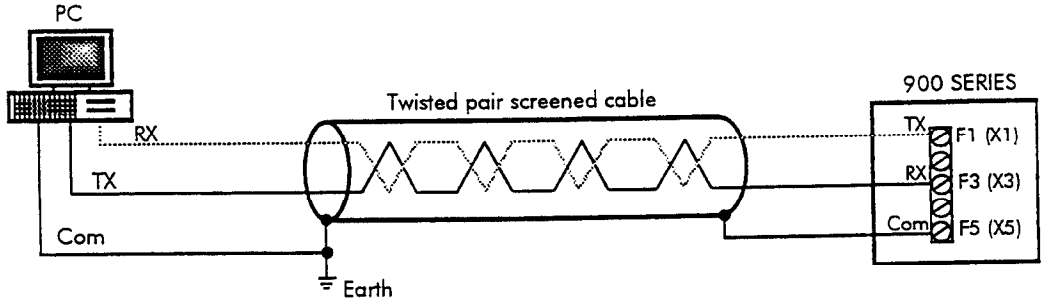
To use RS232 the PC will be equipped with an RS232 port, usually referred to as COM 1.

To construct the ideal cable for RS232 operation use a three core screened cable. For communication over short distances in a low noise environment it is normal to use a two core cable as described here.

The terminals used for RS232 digital communications are listed in the table below. Some PC's use a 25 way connector although the 9 way is more common.

Standard Cable Colour	PC socket pin no.		PC Function *	Instrument Terminal		Instrument Function
	9 way	25 way		902-4	900EPC	
Black	2	3	Receive (RX)	F1	X1	Transmit (TX)
Clear	3	2	Transmit (TX)	F3	X3	Receive (RX)
Screen	5	7	Common	F5	X5	Common
Link together	1	6	Rec'd line sig. detect			
	4	8	Data terminal ready			
	6	11	Data set ready			
Link together	7	4	Request to send			
	8	5	Clear to send			
Screen		1	Earth			

* These are the functions normally assigned to socket pins. Please check your PC manual to confirm.



A standard RS232 communication cable is available which will provide a prewired 9 way PC connector and 3m of cable for connecting to an instrument. The order code is:

CABLE/9PINPC/NOPLUG/232/3.0M

Note, this cable does not provide an earth connection or the link pin connections.

Wiring RS422/485

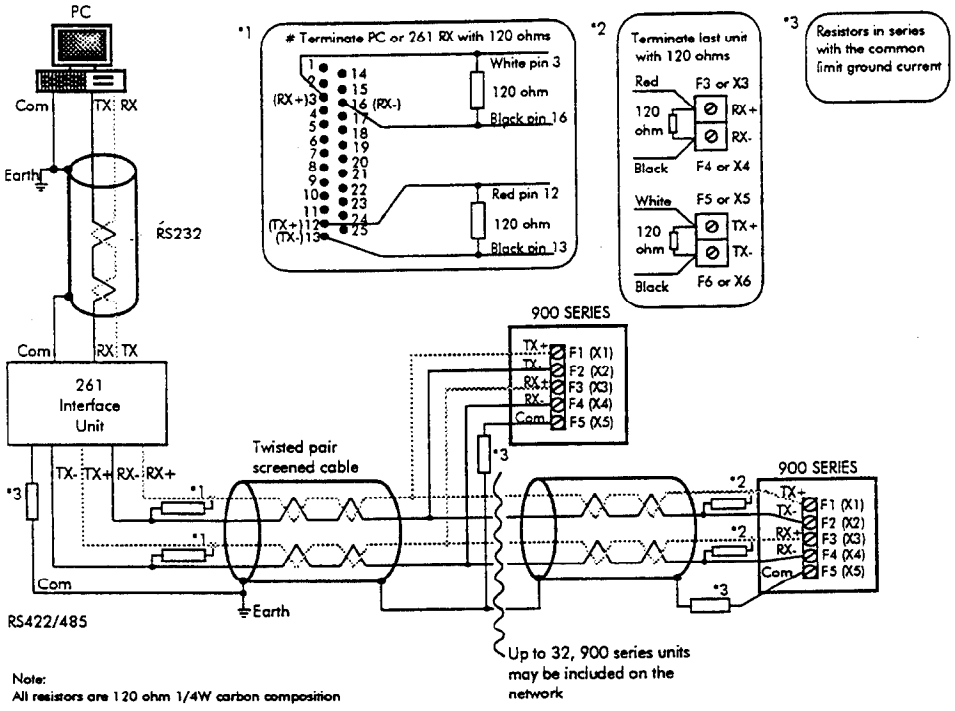
To use RS422/485, buffer the RS232 port of the PC with a suitable RS232/RS422 converter. The Eurotherm Controls 261, RS232/RS422 Universal Serial Interface unit is recommended for this purpose. Refer to Appendix B for a functional diagram of the 261. Instruments on a RS422/485 communication network should be chain connected and not star connected.

To construct the ideal cable for RS422/485 operation use a screened cable with two twisted pairs plus a separate core for common. For all but the most extreme environments it is normal to use a four core cable as described here.

The terminals used for RS422/485 digital communications are listed in the table below. A 25 way connector is used on the PC or 261 interface unit.

Standard Cable Colour	PC socket pin no. 25 way	PC Function *	Instrument Terminal		Instrument Function
			902-4	900EPC	
White	3	Receive (RX+)	F1	X1	Transmit (TX+)
Black	16	Receive (RX-)	F2	X2	Transmit (TX-)
Red	12	Transmit (TX+)	F3	X3	Receive (RX+)
Black	13	Transmit (TX-)	F4	X4	Receive (RX-)
Screen via 120 ohm	7	Common	F5	X5	Common
Screen	1	Earth			

* These are the functions normally assigned to socket pins. Please check your PC manual to confirm.



A standard RS232 communication cable is available which will provide a prewired 9 way PC connector, 3m of cable and a 25 way connector for the 261. The order code is:

CABLE/9PINPC/25PIN261/232.3.0M

A standard RS422/485 communication cable is available which will provide a prewired 25 way connector for the 261 and 3m of cable for connecting to an instrument. The order code is:

CABLE/25PIN261/NOPLUG/422/3.0M

Note that these cables do not provide earth connections, ground current limiting resistors, or terminating resistors.

RS422/485 Termination

To avoid signal reflections and interference effects, terminate RS422/485 transmition lines at either end. This will mean four termination resistors, two at each extreme of the network.

A suitable resistor for terminating the transmission lines is a 120 ohm, 1/4W, carbon composition. The use of these resistors is recommended, although they may be unnecessary for short cable lengths.

The following diagram illustrates the correct termination of an RS422/485 network.

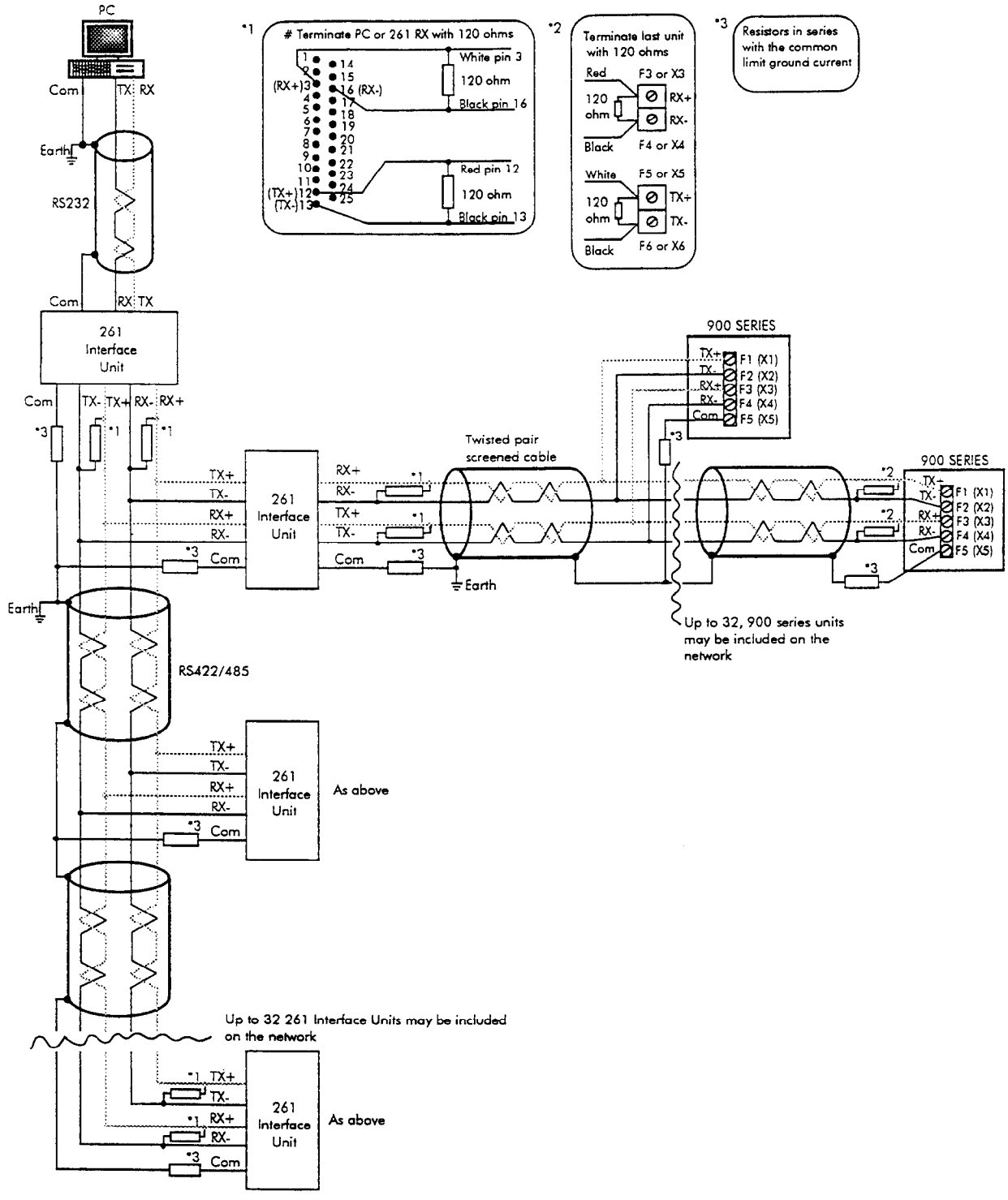
Large RS422/485 networks

Networks with more than 32 instruments will require buffering of the communication lines. The Eurotherm Controls 261, RS232/RS422 Universal Serial Interface unit is recommended for this purpose.

The 261 will require modifying to set the Transmit lines non tristate. Change links 4 and 5 from position B to A. Refer to Appendix B for a functional diagram of the 261. Contact Eurotherm Controls Ltd. for further information when specifying large networks.

Instruments on a RS422/485 communication network should be chain connected and not star connected.

The following diagram illustrates the wiring of a network for communicating with a large number of 900 Series instruments.



Note:
All resistors are 120 ohm 1/4W carbon composition

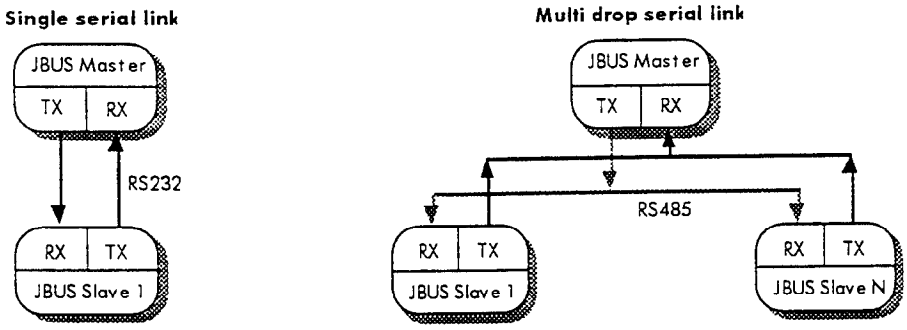
Chapter 3 JBUS and MODBUS PROTOCOL

This chapter introduces the principles of the JBUS and MODBUS communication protocols.

Protocol basics

A data communication protocol defines the rules and structure of messages used by all devices on a network for data exchange. This protocol also defines the orderly exchange of messages, and the detection of errors.

MODBUS and JBUS define a digital communication network to have only one MASTER and one or more SLAVE devices. Either a single or multi-drop network is possible. The two types of communications networks are illustrated in the diagram below;



A typical transaction will consist of a request sent from the master followed by a response from the slave.

The message in either direction will consist of the following information;

Device Address	Function Code	Data	Error Check Data	End of Transmission

- Each slave has a unique 'device address'
- The device address 0 is a special case and is used for a message broadcast to all slaves *
- Seven types of function code are supported by 900EPC instruments and five types of function code are supported by 902-4 instruments
- The data will include instrument parameters referenced by a 'parameter address'

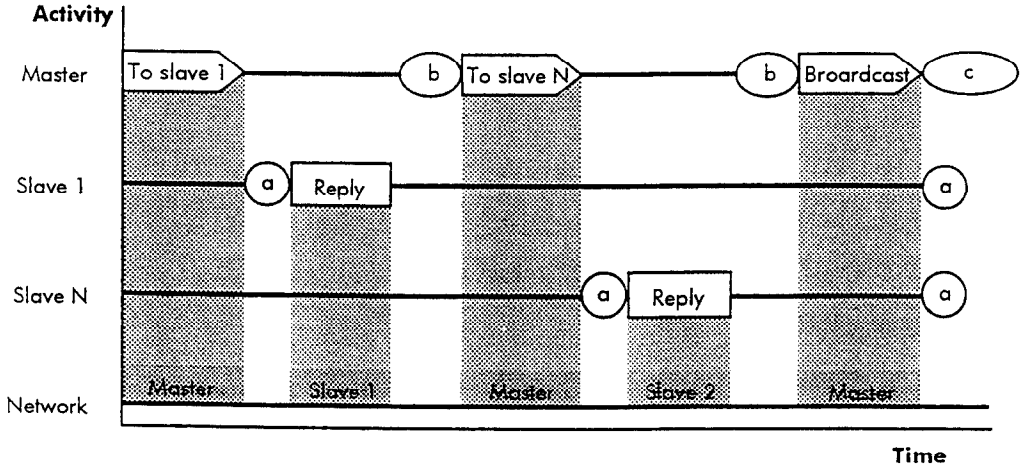
* Two types of transaction are available to a master addressing slave devices on the communications network;

Sending a communication with a unique device address will cause only the device with that address to respond. That device will check for errors, perform the requested task and then reply with its own address, data and a check sum.

Sending a communication with the device address '0' is a broadcast communication that will send information to all devices on the network. Each will perform the required action but will not transmit a reply.

Typical transmission line activity

This diagram is to illustrate typical sequence of events on a JBUS transmission line.



Period 'a' The processing time, (latency), required by the slave to complete the command and construct a reply.

Period 'b' The processing time required by the master to analyse the slave response and formulate the next command.

Period 'c' The wait time calculated by the master for the slaves to perform the operation. None of the slaves will reply to a broadcast message.

For a definition of the time periods required by the network, refer to 'Wait Period' in the section 'Error Response'.

Device address

Each slave has a unique 8 bit device address. The Gould MODBUS Protocol defines the address range limits as 1 to 247. The 900EPC instruments will support an address range of 1 to 255. The 902-4 instruments support an address range 1 to 99. To configure the device address, refer to the instrument Handbook.

Device address 0 is a special case that will broadcast a message to all slave devices simultaneously.

Parameter address

Data bits or data words exchange information between master and slave devices. This data consists of parameters. All parameters communicated between master and slaves have a 16 bit parameter address.

JBUS parameter addresses are equivalent to MODBUS addresses but incremented by 1.
Conversely, to obtain the MODBUS address from the JBUS address simply subtract one.
Subject to this simple address conversion JBUS and MODBUS networks can communicate with each other.

The MODBUS parameter address range is 0000 to FFFEh and the JBUS range is 0001 to FFFFh.
Reading parameter address 0000 on a JBUS network will return the value 0.

Parameter definitions for the 900 Series instruments are in Chapters 4 and 5.
Chapter 4 is a list of the parameters and the corresponding parameter addresses for 902-4 instruments.
Chapter 5 is a list of the parameters and the corresponding parameter addresses for 900EPC instruments.

Parameter resolution

JBUS and MODBUS protocol limit data to 16 bits per parameter. This reduces the active range of parameters to 65536 counts. In the 900 series instruments this is implemented as -32767 (8001h) to +32767 (7FFFh). If an instrument parameter is outside this range then the 900EPC will reply with -32768 (8000h).

The protocol is also limited to integer communication only. The 900 series instruments allow the user to configure either integer or full resolution. In integer mode all parameters will be rounded to the nearest integer value, In full resolution mode the decimal point position will be implied so that 10.001 would be transmitted as 10001. From this, and the 16 bit resolution limitation, the maximum value communicable with 3 decimal place resolution is 32.767. The parameter resolution will be taken from the slave user interface, and the conversion factor must be known to both master and slave when the network is initiated.

Mode of transmission

The mode of transmission describes the structure of information within a message and the number coding system used to exchange a single character of data.

The JBUS and MODBUS Protocols define a mode of transmission for both ASCII and RTU modes of transmission. Eurotherm Controls 900 Series instruments **only** support the **RTU** mode of transmission.

The RTU definition of the mode of transmission for a single character is:

A start bit, eight data bits, a parity bit and one or two stop bits

All Eurotherm Controls 900 Series instruments use 1 stop bit.
For 902-4 instruments, parity may be configured to be NONE or EVEN.
For 900EPC instruments, parity may be configured to be NONE, ODD or EVEN.
If parity is configured to be NONE, no parity bit is transmitted.

The RTU mode of transmission for a single character is represented as follows:

Start	d7	d6	d5	d4	d3	d2	d1	d0	Parity Stop

Message frame format

A message consists of a number of characters sequenced so that the receiving device can understand. This structure is known as the message frame format.

The following diagram shows the sequence defining the message frame format used by JBUS and MODBUS:

Frame start	Device address	Function code	Data	CRC	EOT
3 bytes	1 byte	1 byte	n bytes	2 bytes	3 bytes

The frame start is a period of inactivity at least 3 times the single character transmission time.
For example, at 9600 baud a character with 1 start, 1 stop and 8 data bits will require a 3.5ms frame start.
This period is the implied EOT of a previous transmission.

The device address is a single byte (8-bits) unique to each device on the network.

Function codes are a single byte instruction to the slave describing the action to perform.

The data segment of a message will depend on the function code and the number of bytes will vary accordingly. Typically the data segment will contain a parameter address and the number of parameters to read or write.

The Cyclic Redundancy Check, (CRC) is an error check code and is two bytes, (16 bits) long.

The End of Transmission segment, (EOT) is a period of inactivity 3 times the single character transmission time. The EOT segment at the end of a message indicates to the listening device that the next transmission will be a new message and therefore a device address character.

Cyclic redundancy check

The Cyclic Redundancy Check, (CRC) is an error check code and is two bytes, (16 bits) long. After constructing a message, (data only, no start, stop or parity bits), the transmitting device calculates a CRC code and appends this to the end of the message. A receiving device will calculate a CRC code from the message it has received. If this CRC code is not the same as the transmitted CRC there has been a communication error.

The CRC code is formed by the following steps:

1 Load a 16 bit CRC register with FFFFh.

2 Exclusive OR (⊕) the first 8 bit byte of the message with the with the high order byte of the CRC register.

Return the result to the CRC register.

3 Shift the CRC register one bit to the right.

4 If the over flow bit, (or flag), is 1, exclusive OR the CRC register with A001 hex and return the result to the CRC register.

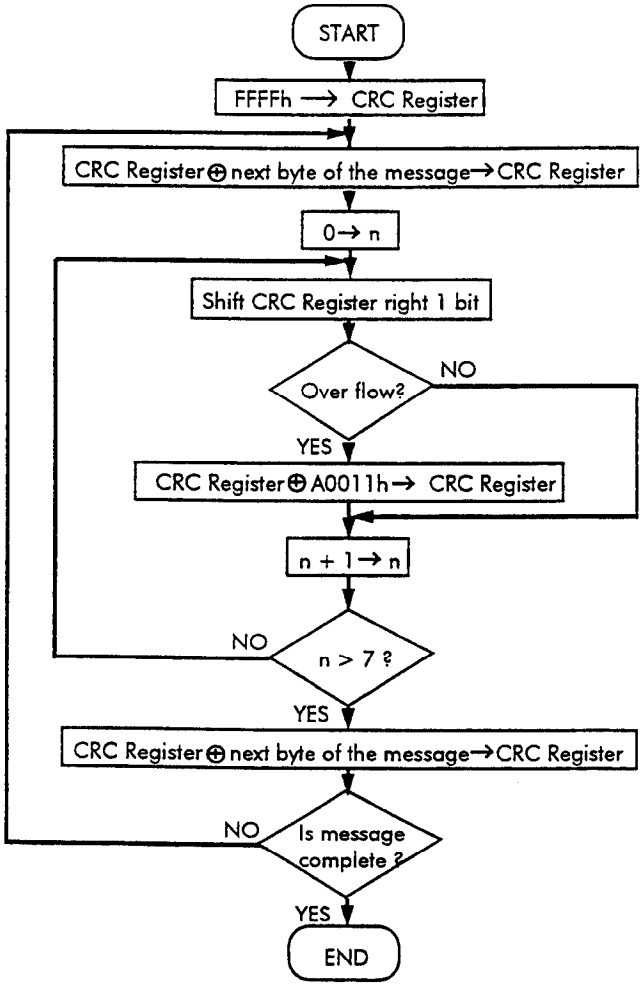
4a If the overflow flag is 0, repeat step 3.

5 Repeat steps 3 and 4 until there have been 8 shifts.

6 Exclusive OR the next 8 bit byte of the message with the high order byte of the CRC register.

7 Repeat step 3 through to 6 until all bytes of the message have been exclusive OR with the CRC register and shifted 8 times.

8 The contents of the CRC register are the 2 byte CRC error code and are added to the message



Example of a CRC calculation

This example is a request to read from the slave unit at address 02, the fast read of the status (07).

Function	16 Bit Register				Carry flag
	LSB		MSB		
Load register with FFFF hex	1111	1111	1111	1111	0
First byte of the message (02)			0000	0010	
Exclusive OR	1111	1111	1111	1101	
1st shift right	0111	1111	1111	1110	1
A001	1010	0000	0000	0001	
Exclusive OR (carry = 1)	1101	1111	1111	1111	
2nd shift right	0110	1111	1111	1111	1
A001	1010	0000	0000	0001	
Exclusive OR (carry = 1)	1100	1111	1111	1110	
3rd shift right	0110	0111	1111	1111	0
4th shift right (carry = 0)	0011	0011	1111	1111	1
A001	1010	0000	0000	0001	
Exclusive OR (carry = 1)	1001	0011	1111	1110	
5th shift right	0100	1001	1111	1111	0
6th shift right (carry = 0)	0010	0100	1111	1111	1
A001	1010	0000	0000	0001	
Exclusive OR (carry = 1)	1000	0100	1111	1110	
7th shift right	0100	0010	0111	1111	0
8th shift right (carry = 0)	0010	0001	0011	1111	1
A001	1010	0000	0000	0001	
Exclusive OR (carry = 1)	1000	0001	0011	1110	
Next byte of the message (07)			0000	0111	
Exclusive OR (shift = 8)	1000	0001	0011	1001	
1st shift right	0100	0000	1001	1100	1
A001	1010	0000	0000	0001	
Exclusive OR (carry = 1)	1110	0000	1001	1101	
2nd shift right	0111	0000	0100	1110	1
A001	1010	0000	0000	0001	
Exclusive OR (carry = 1)	1101	0000	0100	1111	
3rd shift right	0110	1000	0010	0111	1
A001	1010	0000	0000	0001	
Exclusive OR (carry = 1)	1100	1000	0010	0110	
4th shift right	0110	0100	0001	0011	0
5th shift right (carry = 0)	0011	0010	0000	1001	1
A001	1010	0000	0000	0001	
Exclusive OR (carry = 1)	1001	0010	0000	1000	
6th shift right	0100	1001	0000	0100	0
7th shift right (carry = 0)	0010	0100	1000	0010	0
8th shift right (carry = 0)	0001	0010	0100	0001	0
CRC error check code	12h		41h		

The final message transmitted, including the CRC code, is as follows;

Device address		Function code		CRC MSB		CRC LSB	
02h		07h		41h		12h	
0000	0010	0000	0111	0100	0001	0001	0010

↑ First bit — Transmission order — Last bit ↑

Function codes

Function codes are a single byte instruction to the slave describing the action to perform.

The following communication functions are supported by 900 Series instruments:

Function code	Function	902-4	900EPC
01 or 02	Read n bits	yes	yes
03 or 04	Read n words	yes	yes
05	Write a bit	yes	yes
06	Write a word	yes	yes
07	Fast Read of Status	yes	yes
15	Write n bits	no	yes
16	Write n words	no	yes

Only the write function codes 05, 06, 15 and 16 will respond to a broadcast mode address.

Data bits or data words exchange information between master and slave devices. This data consists of parameters.

Parameter definitions for the 900 Series instruments are in Chapters 4 and 5.
Chapter 4 is a list of the parameters and the corresponding parameter addresses for 902-4 instruments.
Chapter 5 is a list of the parameters and the corresponding parameter addresses for 900EPC instruments.

The sections that follow explain the message frame format for each function code.
Examples of implementation are based on the 900EPC instrument and for a description of the parameter addresses, refer to Chapter 5.

Read n bits

Function code: 01 or 02, (01h or 02h)

Command:

Device address	Function code 01 or 02	Address of first bit		Number of bits to read		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

The number of bits to be read must be less than 2000.

Reply:

Device address	Function code 01 or 02	Number of bytes read	First byte of data	....	Last byte of data	CRC	
1 byte	1 byte	1 byte	1 byte	....	1 byte	MSB	LSB

The first data byte contains the status of the first 8 bits, with the least significant bit being the first bit. The second data byte contains the status of the next 8 bits, etc.. Unused bits are set to zero.

Example: From the 900EPC slave at device address 19d, read 14d bits, beginning at parameter address 2d.

Command:

Device address	Function code	Address of first bit		Number of bits to read		CRC	
13	01	00	02	00	0E	1F	7C

Reply:

Device address	Function code	Number of bytes read	First byte of data	Second byte of data	CRC	
13	01	02	40	02	B1	FE

Data byte	1st byte (40h)								2nd byte (02h)							
Param. address	9	8	7	6	5	4	3	2	17	16	15	14	13	12	11	10
Bit values	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0

This expansion of the data bytes illustrates the relationship between data and the parameter addresses.

The reply indicates that PV is in sensor break and output rate limit is enabled.

Because only 14 bits are requested in the message, the parameters 16 and 17 return zero.

Read n words

Function code: 03 or 04, (03h or 04h)

Command:

Device address	Function code 01 or 02	Address of first bit		Number of bits to read		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

The maximum number of words that may be read is 125.

Reply:

Device address	Function code 03 or 04	Number of bytes read	Value of the first word		....	Value of the last word		CRC	
1 byte	1 byte	1 byte	MSB	LSB	...	MSB	LSB	MSB	LSB

Example: From the 900EPC slave at device address 2d, read 2d words from parameter address 8d (integral time, Ti and derivative time, Td).

Command:

Device address	Function code	Address of first word		Number of words to read		CRC	
02	03	00	08	00	02	45	FA

Reply: (If the 900EPC is configured with **integer** resolution and Ti=10.0s, Td=5.0s)

Device address	Function code 03 or 04	Number of bytes read	Value of first word		Value of the last word		CRC	
03	03	04	00	0A	00	05	29	32

Reply: (If the 900EPC is configured with **full** resolution and Ti=10.0s, Td=5.0s)

Device address	Function code 03 or 04	Number of bytes read	Value of first word		Value of the last word		CRC	
02	03	04	00	64	00	32	09	39

As the decimal point is not transmitted, the master must scale the response; 64h = 100d =>10.0 and 32h = 50d =>5.0

Write a bit

Function code: 05, (05h)

Command:

Device address	Function code 05	Address of bit		Value of bit		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

The LSB of 'Value of bit' is always set to 00. The MSB is used to write the value of the addressed bit. To set a bit value of 1, either transmit 01h or FFh. To set a bit value of 0 transmit 00h.

A device address 00 will broadcast the data to all devices on the network.

Reply: (There will be no reply to a command broadcast to the device address 00.)

Device address	Function code 05	Address of bit		Value of bit		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

The reply to function 05 is the same as the command.

Example: Write to the 900EPC slave at device address 2d and set the instrument to manual.

(The bit at parameter address 1d is set).

Command:

Device address	Function code	Address of bit		Value of bit		CRC	
02	05	00	01	01	00	90	A9

Reply:

Device address	Function code	Address of bit		Value of bit		CRC	
02	05	00	01	01	00	90	A9

Write a word

Function code: 06, (06h)

Command:

Device address	Function code 06	Address of word		Value of word		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

A device address 00 will broadcast the data to all devices on the network.

Reply: (There will be no reply to a command broadcast to the device address 00.)

Device address	Function code 06	Address of word		Value of word		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

The reply to function 06 is the same as the command.

Example: Write to the 900EPC slave at device address 2d and change the setpoint to 25.0°C. The instrument is configured with full resolution, therefore the required value is 250.

Command:

Device address	Function code	Address of word		Value of word		CRC	
02	06	00	05	00	FA	19	BB

Reply:

Device address	Function code	Address of word		Value of word		CRC	
02	06	00	05	00	FA	19	BB

Fast read of status

Function code: 07, (07h)

The fast read of status command is short to allow a rapid transaction to obtain one byte of frequently needed status information.

Command:

Device address	Function code 07	CRC	
1 byte	1 byte	MSB	LSB

Reply:

Device address	Function code 07	Fast read status byte	CRC	
1 byte	1 byte	1 byte	MSB	LSB

The table below defines the status byte information used by 900 Series instruments.

Bit position	902-4	900EPC
LSB 1	PV sensor break	Loop 1 PV sensor break
2	Manual selected	Loop 1 remote input sensor break
3	Remote selected	Loop 2 PV sensor break
4	Second setpoint selected	Loop 2 remote input sensor break
5	Alarm 1 active	Alarm 1 active
6	Alarm 2 active	Alarm 2 active
7	Self tune selected	Alarm 3 active
MSB 8	Adaptive tune selected	Alarm 4 active

Example: Fast read the status byte from a 900EPC slave at device address 02d.

Command:

Device address	Function code	CRC	
02	07	41	12

Reply:

Device address	Function code	Fast read status byte	CRC	
02	07	95	12	5F

In this example the value of status byte (95h) has the following information;
Loop 1 PV is in sensor break
Loop 1 remote input is not in sensor break
Loop 2 PV is in sensor break
Loop 2 remote input is not in sensor break
Alarm 1 is active
Alarm 2 is not active
Alarm 3 is not active
Alarm 4 is active

Write n bits

This function code is only available for the 900 EPC Series.

Function code: 15, (0Fh)

Command:

Device address	Function code 0F	Address of first bit		Number of bits to force		Number of data bytes (n)	Data	CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	1 byte	n bytes	MSB	LSB

The maximum number of bits that can be transmitted is 2000 which corresponds to 250 bytes of data.

The first data byte contains the required status of the first 8 bits, with the least significant bit being the first bit. The second data byte contains the status of the next 8 bits, etc. Unused bits are set to zero.

A device address 00 will broadcast the data to all devices on the network.

Reply: (There will be no reply to a command broadcast to the device address 00.)

Device address	Function code 0F	Address of first bit		Number of bits forced		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

Example: Write to the 900EPC slave at device address 2d and reset alarm log 1, (bit parameter address 305) and alarm log 3, (bit parameter address 307).

Command:

Device address	Function code	Address of first bit		Number of bits to force		Number of data bytes (n)	Data	CRC	
02	0F	01	31	00	03	01	05	73	54

An expansion of the data bytes illustrates the relationship between data and the parameter addresses. Bits 308 to 312 have no effect as only 3 bits are written.

Data byte	Data byte (05h)							
Param. address	312	311	310	309	308	307	306	305
Bit values	0	0	0	0	0	1	0	1

Reply:

Device address	Function code	Address of first bit		Number of bits forced		CRC	
02	0F	01	31	00	03	MSB	LSB

Write n words

This function code is only available for the 900 EPC Series.

Function code: 16, (10h)

Command:

Device address	Function code 10	Address of first word		Number of words to write		Number of data bytes (n)	Data	CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	1 byte	n bytes	MSB	LSB

The maximum number of words that can be transmitted is 125 which corresponds to 250 bytes of data.

The first two bytes are data with the required value of the first parameter, MSB first. Following pairs of bytes are data for the consecutive parameter addresses.

A device address 00 will broadcast the data to all devices on the network.

Reply: (There will be no reply to a command broadcast to the device address 00.)

Device address	Function code 10	Address of first word		Number of words written		CRC	
1 byte	1 byte	MSB	LSB	MSB	LSB	MSB	LSB

Example: Write to the 900EPC slave at device address 2d which is configured with full resolution.

Local setpoint	=	30.0 (300) parameter address 5d
Prop band	=	4.1 (41) parameter address 6d
Output rate limit	=	100.0 (1000) parameter address 7d
Integral time	=	15.0 (150) parameter address 8d

Command:

Device address	Function code	Address of first word		Number of words to write		Number of data bytes	Data	CRC	
02	10	00	05	00	04	08	See below	88	A1

Data (300) for address 05		Data (41) for address 06		Data (1000) for address 07		Data (150) for address 08	
01	2C	00	29	03	E8	00	96

Reply:

Device address	Function code	Address of first word		Number of words written		CRC	
02	10	00	05	00	04	D1	F8

Error response

The JBUS and MODBUS protocol define the response to a number of error conditions. A slave device is able to detect a corrupted command or, one that contains an incorrect instruction, and will respond with an error code.

With some errors the slave devices on the network are unable to make a response. After a wait period the master will interpret the failure to reply as a communication error. The master should then re-transmit the command.

Error response codes

A slave device that has detected a corrupted command or a command that contains an incorrect instruction, will respond with an error message. The error message has the following syntax.

Device Address	Function code	Error response code	CRC	
1 byte	1 byte	1 byte	MSB	LSB

The Function code byte contains the transmitted function code but with the most significant bit set to 1. (This is the result of adding 128d to the function code.)

The error response code indicates the type of error detected.
The 900 series instruments support the following error response codes:

Code	902-4	900EPC	Error	Description
01	yes	yes	Illegal Function	The received function is not an allowable function for the addressed slave
02	yes	yes	Illegal Data Address	The address referenced in the data field is not an allowable address for the slave
03	yes	yes	Illegal Data Value	The value referenced in the data field is not allowable in the addressed slave location
04	yes	yes	Failure to perform an operation	An abortive error has occurred
07	no	yes	Non consecutive segment	
11	no	yes	Programme busy	The user interface has priority over comms. The programme edit page is visible.
12	no	yes	Programme read only	The programme is loaded or is a sub programme of a loaded programme
13	no	yes	Function not available	

Example: In this attempt to fast read the status byte from a 900EPC slave at device address 02d the unsupported function code 08 is used, (the function code should be 07).

Command:

Device address	Function code	CRC	
02	08	MSB	LSB

Reply:

Device Address	Function code	Error response code	CRC	
02	88	01	MSB	LSB

Wait period

There are several errors for which the slave devices on the network are unable to make a response:

- If the master attempts to use an invalid address then no slave device will receive the message.
- For a message corrupted by interference, the transmitted CRC will not be the same as the internally calculated CRC. The slave device will reject the command and will not reply to the master.

After a wait period, the master will re-transmit the command.

The wait period should exceed the instrument latency plus the message transmission time.

Latency

The time taken for the 900 series instrument process a message and start the transmission of a reply is called the latency.

The single parameter communications such as read 1 bit (function 01h), read 1 word (function 03h), write 1 bit (function 05h) and write 1 word (function 06h) are processed within 10ms.

The multi parameter functions, read n bits (function 01h), read n words (function 03h), write 1 bit (function 05h), fast read of status (function 07h), write n bits (function 0Fh) and write n words (function 10h) are processed within multiples of 50ms. The latency will depend on the instrument activity and may take 100, 150 or 200ms ect..

Message transmission time

The time required to transmit a message will depend on the length of the message and the baud rate.

$$\text{Message transmission time} = \frac{(\text{Number of bytes in the message} + 3) * \text{Number of bits per character}}{\text{Baud rate}}$$

To find the number of bytes, refer to the relevant function code. The three extra bytes are for the End of Transmission, (EOT), characters.

The number of bits per character will be ten, or eleven if a parity bit is used. (1 start bit, 8 data bits, an optional parity bit and 1 stop bit. See Mode of Transmission).

For example reading a single bit with the function code 01 at 9600 baud, (no parity bit);

$$\text{Command transmission time} = \frac{(8 + 3) * 10}{9600} = 11.5\text{ms}$$

$$\text{Reply transmission time} = \frac{(6 + 3) * 10}{9600} = 9.4\text{ms}$$

Chapter 4 902-4 PARAMETER ADDRESSES

The 902-4 series of instruments comply with the JBUS and MODBUS protocol defined in Chapter 3. This chapter will define features and parameter addresses specific to the 902-4 series of instruments.

This information applies to the following software releases;

All instruments, versions 1.00, 1.01, 1.02, 1.03

Parameter access restrictions

A 902-4 instrument may be configured for a wide variety of functions and some parameters will only be available if the related function is configured. JBUS addresses that are not supported have no parameter assigned. In normal operating mode all configuration parameters are read only. To be able to write to these parameters, the instrument must be in configuration mode.

An attempt to **read** parameters that are either not available or not supported, will result in the value 8000h, (or 0000h for address 7) being returned.

An attempt to **write** to a parameter that is not available will result in an 'INVALID ADDRESS' error message being returned. An attempt to **write** to a parameter that cannot be altered will result in an 'INVALID DATA' error message.

See Error Response in Chapter 3 for details of JBUS error messages.

Using parameter lists

The following sections list the parameters and their addresses. The lists have been broken into word addressable parameters and bit addressable parameters.

Only JBUS addresses are listed. Remember that MODBUS address = JBUS address - 1.

Parameters are listed in ascending order of JBUS address. Related functions are not always grouped together.

Status words are defined in the section Status Word Definitions. In the section, Word Addressable Parameters, these parameters have the comment, '(see SWD)'.

For example; The parameter, 'Status word', which has a JBUS address of 4.

Word addressable parameters

Parameter Description	R/O or R/W	JBUS Address dec	JBUS Address hex	Bi-synch Mnemonic
Measured value	R/O	1	1h	PV
Setpoint 1	R/W	2	2h	SL
Output power (R/W in manual)	R/O	3	3h	OP
Status Word (see SWD)	R/W	4	4h	SW
Setpoint 1	R/W	5	5h	SL
Proportional band	R/W	6	6h	XP
Not used (set to 0000h)		7	7h	
Integral time	R/W	8	8h	TI
Derivative time	R/W	9	9h	TD
Heat cycle time for channel 1	R/W	10	Ah	CH
Display minimium	R/O	11	Bh	1L
Display maximium	R/O	12	Ch	1H
Alarm 1 setpoint	R/W	13	Dh	1A
Alarm 2 setpoint	R/W	14	Eh	2A
Not used (set to 8000h)		15	Fh	
Heat / cool deadband	R/W	16	10h	HC
Cutback low	R/W	17	11h	LB
Cutback high	R/W	18	12h	HB
Relative cool gain	R/W	19	13h	RG
Output 2 cycle time	R/W	20	14h	C2
Motor travel time	R/W	21	15h	TT
Not used (set to 8000h)		22	16h	
Valve positioner, pot input value	R/O	23	17h	MP
Setpoint 1	R/W	24	18h	SL
Setpoint 2	R/W	25	19h	S2
Remote input	R/O	26	1Ah	RI
Local setpoint	R/W	27	1Bh	RT
Manual reset	R/W	28	1Ch	MR
Cool cycle time	R/W	29	1Dh	CC
Output 1 limit	R/W	30	1Eh	HO
Output 2 limit	R/W	31	1Fh	LO
Remote output 1 limit	R/W	32	20h	RH
Remote output 2 limit	R/W	33	21h	RC
Power during sensor break	R/W	34	22h	BP
Ramp rate	R/W	35	23h	RR
Time remaining	R/O	36	24h	TM
Adaptive tune trigger point	R/W	37	25h	TR
Emissivity	R/W	38	26h	PE
Error	R/O	39	27h	ER
Optional Status Word (see SWD)	R/W	40	28h	OS
Extended Status Word (see SWD)	R/W	41	29h	XS
Motor minimum limit	R/W	42	2Ah	LE
Motor maximum limit	R/W	43	2Bh	EH
Travel time down	R/W	44	2Ch	Tt
Minimum on time	R/W	45	2Dh	Mt
Valve update time	R/W	46	2Eh	TP

Parameter Description	R/O or R/W	JBUS Address		Bi-synch Mnemonic
		dec	hex	
Not used (set to 8000h)		47	2Fh	
Proportional band 2	R/W	48	30h	P2
Integral time 2	R/W	49	31h	I2
Manual reset 2	R/W	50	32h	R2
Derivative time 2	R/W	51	33h	D2
Relative cool gain 2	R/W	52	34h	G2
Not used (Set to 8000h)		53	35h	
Current programme number	R/W	54	36h	CP
Measured value	R/O	55	37h	PV
Current segment number	R/W	56	38h	OS
Working setpoint	R/W	57	39h	SP
Time remaining	R/O	58	3Ah	TM
Loops remaining	R/O	59	3Bh	LR
Output status channel 3 (see SWD)	R/W	60	3Ch	O1
Output end status channel 3 (see SWD)	R/W	61	3Dh	O2
Output status channel 4 (see SWD)	R/W	62	3Eh	O3
Output end status channel 4 (see SWD)	R/W	63	3Fh	O4
Loop count	R/W	64	40h	Lc
Holdback	R/W	65	41h	Hb
Ramp 1	R/W	66	42h	r1
Level 1	R/W	67	43h	l1
Dwell 1	R/W	68	44h	t1
Ramp 2	R/W	69	45h	r2
Level 2	R/W	70	46h	l2
Dwell 2	R/W	71	47h	t2
Ramp 3	R/W	72	48h	r3
Level 3	R/W	73	49h	l3
Dwell 3	R/W	74	4Ah	t3
Ramp 4	R/W	75	4Bh	r4
Level 4	R/W	76	4Ch	l4
Dwell 4	R/W	77	4Dh	t4
Ramp 5	R/W	78	4Eh	r5
Level 5	R/W	79	4Fh	l5
Dwell 5	R/W	80	50h	t5
Ramp 6	R/W	81	51h	r6
Level 6	R/W	82	52h	l6
Dwell 6	R/W	83	53h	t6
Ramp 7	R/W	84	54h	r7
Level 7	R/W	85	55h	l7
Dwell 7	R/W	86	56h	t7
Ramp 8	R/W	87	57h	r8
Level 8	R/W	88	58h	l8
Dwell 8	R/W	89	59h	t8
Output status channel 2 (see SWD)	R/W	90	5Ah	O5
Output end status channel 2 (see SWD)	R/W	91	5Bh	O6
		92	5Ch	
Not used (set to 8000h)		to	to	
		106	6Ah	

Parameter Description	R/O or R/W	JBUS AddressBi-synch		Mnemonic
		dec	hex	
Software version number	R/O	107	6Bh	V0
Instrument type (= 9020)	R/O	108	6Ch	II
Display max	R/O	109	6Dh	1H
Display min	R/O	110	6Eh	1L
Setpoint 1 max	R/O	111	6Fh	HS
Setpoint 1 min	R/O	112	70h	LS
Setpoint 2 max	R/O	113	71h	H2
Setpoint 2 min	R/O	114	72h	L2
Local trim high limit	R/O	115	73h	H3
Local trim low limit	R/O	116	74h	L3
Remote high scaler	R/O	117	75h	2H
Remote low scaler	R/O	118	76h	2L
Not used (set to 8000h)		119	77h	
Not used (set to 8000h)		120	78h	
Company code (= 500)	R/O	121	79h	
Instrument type (= 9020)	R/O	122	7Ah	II
Invalid address (and all higher values)		123	7Bh	

Status word definitions

Status word parameters are used to communicate various status information with only one word of data.

Status words are listed here in order of their JBUS address.

Status Word JBUS Address: 4 Bi-synch mnemonic: SW

When the clear status, 0 is not obvious, this is given in brackets.

Status if the bit is set, 1 (Status if the bit is clear, 0)	Bit	R/O or R/W
Data format fixed, (free fromat)	0	R/W
Process input break	1	R/O
Front keys disabled	2	R/W
Bit not used	3	
Bit not used	4	
Parameter changed with front keys	5	R/W
Bit not used	6	
Bit not used	7	
Alarm 1 active	8	R/O
Bit not used	9	
Alarm 2 active	10	R/O
Bit not used	11	
Alarm 1 and 2 active	12	R/O
Setpoint 2 active, (setpoint 1 active)	13	R/W
Manual mode, (auto)	14	R/W
Remote setpoint, (local setpoint)	15	R/W

Optional Status Word JBUS Address: 40 Bi-synch mnemonic: OS

When the clear status, 0 is not obvious, this is given in brackets.

Status if the bit is set, 1 (Status if the bit is clear, 0)	Bit	R/O or R/W
Programme Status LSB	0	
Programme Status See below	1	
Programme Status	2	
Programme Status MSB	3	
Hold has occurred	4	R/O
Skip the current segment	5	R/W
Dwell segment, (ramp segment)	6	R/O
Digital inputs disabled	7	R/W
Segment number LSB	8	R/O
Segment number See below	9	R/O
Segment number	10	R/O
Segment number MSB	11	R/O
Digital output channel 4 active	12	R/W
Digital output channel 3 active	13	R/W
Digital input 2 active	14	R/O
Digital input 1 active	15	R/O

Programme Status

Programme status is only available when a programme is running.

Status	Bit				R/O or R/W
	3	2	1	0	
Reset programme or ramp	0	0	0	0	R/W
Not used	0	0	0	1	
Run programme or ramp	0	0	1	0	R/W
Hold programme or ramp	0	0	1	1	R/W
Programme end	0	1	0	0	R/O
Ramp end (still active *)	0	1	0	1	R/O
Programme in holdback	0	1	1	0	R/O

* Ramp end only applies to the ramp function, not programmers. After completing a ramp, should PV deviate from SP1 the working setpoint will ramp back to SP1 at the current ramp rate.

Segment Number

Segment	Bit				R/O or R/W
	11	10	9	8	
Segment 1	0	0	0	1	R/O
Segment 2	0	0	1	0	R/O
Segment 3	0	0	1	1	R/O
Segment 4	0	1	0	0	R/O
Segment 5	0	1	0	1	R/O
Segment 6	0	1	1	0	R/O
Segment 7	0	1	1	1	R/O
Segment 8	1	0	0	0	R/O

Extended Status Word JBUS Address: 41 Bi-synch mnemonic: XS

When the clear status, 0 is not obvious, this is given in brackets.

Status if the bit is set, 1 (Status if the bit is clear, 0)	Bit	R/O or R/W
Self tune active	0	R/W
Adaptive tune active	1	R/W
Enable broadcast mode	2	R/W
Bit not used	3	R/W
PID set selected independently of SP, (PID selected with SP)	4	R/W
PID set 2 active	5	R/W
Digital input 3 active	6	R/O
Digital output channel 2 active	7	R/W
Programme number LSB	8	R/W
Programme number See below	9	R/W
Programme number	10	R/W
Programme number MSB	11	R/W
Motor control LSB	12	R/W
Motor control See below	13	R/W
Motor control	14	R/W
Motor control MSB	15	R/W

Programme Number

The range available for programme number depends on the model number.

Function	Bit				R/O or R/W
	11	10	9	8	
Programme 0 (902P)	0	0	0	0	R/W
Programme 1	0	0	0	1	R/W
Programme 2	0	0	1	0	R/W
Programme 3	0	0	1	1	R/W
Programme 4 (903P)	0	1	0	0	R/W
Programme 5	0	1	0	1	R/W
Programme 6	0	1	1	0	R/W
etc.					
Programme 14	1	1	1	0	R/W
Programme 15 (904P)	1	1	1	1	R/W

Motor control

For motor valve positioner configurations only. These bits are used to monitor, (or in manual to control), the raise and lower outputs. In auto mode the first three functions are available read only. In manual mode the nudge facility is available. A nudge will cause a raise, (or lower) pulse of minimum on time to be presented to the motor.

Function	Bit				R/O or R/W
	15	14	13	12	
Raise and lower inactive	0	0	0	0	R/W
Lower output active	0	0	0	1	R/W
Raise output active	0	0	1	0	R/W
Nudge lower	0	0	1	1	R/W
Nudge raise	0	1	0	0	R/W

Output Status Channel 3 JBUS Address: 60 Bi-synch mnemonic: O1

This status word defines the state of the programme controlled output channel 3 during each segment. If the bit is clear, (0) the output is not active, if the bit is set, (1) the output is active.

Segment	Bit	R/O or R/W
Ramp 1	0	R/W
Dwell 1	1	R/W
Ramp 2	2	R/W
Dwell 2	3	R/W
Ramp 3	4	R/W
Dwell 3	5	R/W
Ramp 4	6	R/W
Dwell 4	7	R/W
Ramp 5	8	R/W
Dwell 5	9	R/W
Ramp 6	10	R/W
Dwell 6	11	R/W
Ramp 7	12	R/W
Dwell 7	13	R/W
Ramp 8	14	R/W
Dwell 8	15	R/W

Output End Status Channel 3 JBUS Address: 61 Bi-synch mnemonic: O2

This status word defines the state of the programme controlled output channel 3 during the end segment. If the bit is clear, (0) the output is not active, if the bit is set, (1) the output is active.

Segment	Bit	R/O or R/W
End	0	R/W
Bits not used	1 to 15	

Output Status Channel 4 JBUS Address: 62 Bi-synch mnemonic: O3

This status word defines the state of the programme controlled output channel 2 during each segment. If the bit is clear, (0) the output is not active, if the bit is set, (1) the output is active.

Function	Bit	R/O or R/W
Ramp 1	0	R/W
Dwell 1	1	R/W
Ramp 2	2	R/W
Dwell 2	3	R/W
Ramp 3	4	R/W
Dwell 3	5	R/W
Ramp 4	6	R/W
Dwell 4	7	R/W
Ramp 5	8	R/W
Dwell 5	9	R/W
Ramp 6	10	R/W
Dwell 6	11	R/W
Ramp 7	12	R/W
Dwell 7	13	R/W
Ramp 8	14	R/W
Dwell 8	15	R/W

Output End Status Channel 4 JBUS Address: 63 Bi-synch mnemonic: O4

This status word defines the state of the programme controlled output channel 2 during the end segment. If the bit is clear, (0) the output is not active, if the bit is set, (1) the output is active.

Segment	Bit	R/O or R/W
End	0	R/W
Bits not used	1 to 15	

Output Status Channel 2 JBUS Address: 90 Bi-synch mnemonic: O5

This status word defines the state of the programme controlled output channel 2 during each segment. If the bit is clear, (0) the output is not active, if the bit is set, (1) the output is active.

Segment	Bit	R/O or R/W
Ramp 1	0	R/W
Dwell 1	1	R/W
Ramp 2	2	R/W
Dwell 2	3	R/W
Ramp 3	4	R/W
Dwell 3	5	R/W
Ramp 4	6	R/W
Dwell 4	7	R/W
Ramp 5	8	R/W
Dwell 5	9	R/W
Ramp 6	10	R/W
Dwell 6	11	R/W
Ramp 7	12	R/W
Dwell 7	13	R/W
Ramp 8	14	R/W
Dwell 8	15	R/W

Output End Status Channel 2 JBUS Address: 91 Bi-synch mnemonic: O6

This status word defines the state of the programme controlled output channel 2 during the end segment. If the bit is clear, (0) the output is not active, if the bit is set, (1) the output is active.

Segment	Bit	R/O or R/W
End	0	R/W
Bits not used	1 to 15	

Bit addressable parameters

When the clear status, (0) is not obvious, this is given in brackets.

Status if the bit is set, 1 (Status if the bit is clear, 0)	R/O or R/W	JBUS Address dec	JBUS Address hex	Bi-synch Mnemonic
Process input break	R/O	1	1h	
Manual, (auto)	R/W	2	2h	
Remote, (local)	R/W	3	3h	
Setpoint 2, (setpoint 1)	R/W	4	4h	SW
Alarm 1 active	R/O	5	5h	
Alarm 2 active	R/O	6	6h	
Self tune active	R/W	7	7h	XS
Adaptive tune active	R/W	8	8h	XS
Not used - set to 0		9	9h	
Process input break	R/O	10	Ah	
Front keys disabled	R/W	11	Bh	
Not used - set to 0		12	Ch	
Not used - set to 0		13	Dh	
Parameter changed with front keys	R/O	14	Eh	
Not used - set to 0		15	Fh	
Not used - set to 0		16	10h	
Alarm 2 active	R/O	17	11h	SW
Not used - set to 0		18	12h	
Alarm 1 active	R/O	19	13h	
Not used - set to 0		20	14h	
Alarm 1 or 2 active	R/O	21	15h	
Setpoint 2, (setpoint 1)	R/W	22	16h	
Remote, (local)	R/W	23	17h	
Manual, (auto)	R/W	24	18h	
Self tune active	R/W	25	19h	XS
Adaptive tune active	R/W	26	1Ah	XS
		27	1Bh	
Not used - set to 0		to		
		40	28h	
Programme status LSB	R/O	41	29h	
Programme status See below	R/O	42	2Ah	
Programme status	R/O	43	2Bh	
Programme status MSB	R/O	44	2Ch	
Hold logged	R/O	45	2Dh	
Skip current segment	R/W	46	2Eh	
Dwell, (ramp)	R/O	47	2Fh	
Not used - set to 0		48	30h	OS
Segment number LSB	R/O	49	31h	
Segment number See below	R/O	50	32h	
Segment number	R/O	51	33h	
Segment number MSB	R/O	52	34h	
Output channel 4 active	R/O	53	35h	
Output channel 3 active	R/O	54	36h	
Digital input 2 active	R/O	55	37h	
Digital input 1 active	R/O	56	38h	

Programme Status

Programme status is only available when a programme or ramp is active.

Status	Bit				R/O or R/W
	44	43	42	41	
Reset programme or ramp	0	0	0	0	R/W
Not used	0	0	0	1	
Run programme or ramp	0	0	1	0	R/W
Hold programme or ramp	0	0	1	1	R/W
Programme end	0	1	0	0	R/O
Ramp end (still active *)	0	1	0	1	R/O
Programme in holdback	0	1	1	0	R/O

* Ramp end only applies to the ramp function, not programmers. After completing a ramp, should PV deviate from SP1, the working setpoint will ramp back to SP1 at the current ramp rate.

Segment Number

Segment	Bit				R/O or R/W
	11	10	9	8	
Segment 1	0	0	0	1	R/O
Segment 2	0	0	1	0	R/O
Segment 3	0	0	1	1	R/O
Segment 4	0	1	0	0	R/O
Segment 5	0	1	0	1	R/O
Segment 6	0	1	1	0	R/O
Segment 7	0	1	1	1	R/O
Segment 8	1	0	0	0	R/O

Chapter 5 900 EPC JBUS PARAMETERS

The 900 EPC series of instruments comply with the JBUS and MODBUS protocol defined in chapter 3. This chapter will define features specific to the 900 EPC series of instruments.

This information applies to the following software releases;

Controller instruments, versions 2.50
Programmer instruments, versions 5.11

Parameter address grouping

Parameter addresses in the 900 EPC are divided into functional groups. (Loop 1 and loop 2 parameter addresses are offset by 500).

General word parameter addresses are arranged in the following grouping:

Parameter Group Description	Address Range	Page
Loop 1	1 to 400	5-3
Loop 1 diagnostic	401 to 500	5-7
Loop 2	501 to 900	5-3
Loop 2 diagnostic	901 to 1000	5-7
Not used	1001 to 2000	-
General	2001 to 2900	5-9
General diagnostic	2901 to 3000	5-14
Configuration	3001 to 5000	5-16

Programmer word parmeter addresses are arranged in the following grouping; (see page 5-51 for explanation)

Parameter Group Description	Address Range	Page
Loop 1 programmer control	5001 to 5100	5-57
Loop 2 programmer control	5101 to 5200	5-57
Programme status and size	5201 to 5300	5-58
Not used	5301 to 5500	-
Programme general (20 progs)	5501 to 5660	5-60
Programme general (50 progs)	5501 to 5900	5-60
Not used	5901 to 6000	-
Programme segments	6001 to 54000	5-65
Not used	54001 to 65535	-

Status bit parameter addresses are arranged in the following grouping:

Status Bit Group Description	Address Range	Page
Loop 1	1 to 100	5-80
Loop 2	101 to 200	5-80
General	201 to 300	5-80
Alarm and totaliser	301 to 350	5-81
Digital I/O	351 to 400	5-82
Programmer	401 to 450	5-83
Programable logic	451 to 500	5-84
User interface access	501 to 600	5-84
Not used	601 up	-

Parameter access restrictions

A 900 EPC instrument may be configured for a wide variety of functions and some parameters will only be available if the related function is configured. JBUS addresses that are not supported have no parameter assigned. In normal operating mode all configuration parameters are read only. To be able to write to these parameters, the instrument must be in configuration mode.

An attempt to **read** parameters that are either not available or not supported, will result in the value 8000h being returned. If the address range of the parameter is outside those listed in the parameter address grouping above, then an error message will be returned indicating an 'INVALID ADDRESS'.

An attempt to **write** to a parameter that is not available will result in an 'INVALID ADDRESS' error message being returned. An attempt to **write** to a parameter that cannot be altered will result in an 'INVALID DATA' error message.

The block write facility is used to communicate to a number of consecutively addressed parameters with one message. A block write containing unavailable addresses will write to all available parameters and ignore any unavailable or unalterable parameters.

See Error Response in Chapter 3 for details of JBUS error messages.

Using parameter lists

The following sections list the parameters and their addresses. The lists have been broken into word addressable parameters and bit addressable parameters.

Only JBUS addresses are listed. Remember that MODBUS address = JBUS address - 1.

Parameters are listed in ascending order of JBUS address to facilitate the use of block communications.

Unused addresses are not included in this list. Related functions are not always grouped together.

When a loop 2 JBUS Address is 'N/A', that parameter is independent of the loop and is a general instrument parameter.

Many parameters use a set of integer numbers to define functions. The parameter description includes the definition of these functions. Where parameters use the same definitions for a set of values, subsequent occurrences refer to the loop 1 JBUS address where the definition occurs.

For example; The parameter, 'Requested valve action - channel 1', which has a loop 1 JBUS address of 4, defines the meaning of the numbers 0 to 4 sent to this address. 'Requested valve action - channel 2', which has a loop 1 JBUS address of 97, uses the same definition and refers back with the comment, '(as 4)'.

Status words are defined in the section Status Word Definitions (see page 5-69). In the section, Word Addressable Parameters, these parameters have the comment, '(see SWD)'.

For example; The parameter, 'Loop status word', which has a loop 1 JBUS address of 51.

General word addressable parameters

Loop parameters

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Process variable	1	1h	501	1f5h	PV
Working setpoint	2	2h	502	1f6h	SP
Output	3	3h	503	1f7h	OP
Requested valve action - channel 1 0 Valve stationary 1 Lower valve 2 Raise valve 3 Nudge lower 4 Nudge raise	4	4h	504	1f8h	VO
Setpoint 1	5	5h	505	1f9h	SL
Proportional band	6	6h	506	1fAh	XP
Output rate limit	7	7h	507	1fBh	OR
Integral time	8	8h	508	1fCh	TI
Derivative time	9	9h	509	1fDh	TD
Cycle time - channel 1	10	Ah	510	1fEh	CH
Process input display low limit	11	Bh	511	1fFh	1L
Process input display high limit	12	Ch	512	200h	1H
On off sensor break power 0 0% sensor break power 1 100% sensor break power 2 -100% sensor break power	13	Dh	513	201h	BO
On off deadband - channel 1	14	Eh	514	202h	DB
On off deadband - channel 2	15	Fh	515	203h	B2
Deadband	16	10h	516	204h	HC
Cutback low value	17	11h	517	205h	LB
Cutback high value	18	12h	518	206h	HB
Relative output 2 gain	19	13h	519	207h	RG
Valve update time	20	14h	520	208h	TP
Motor travel time - channel 1	21	15h	521	209h	TT
VP control sensor break action - channel 1 0 Maintain valve position 1 Drive valve fully closed 2 Drive valve fully open	22	16h	522	20Ah	BV
Setpoint 1	24	18h	524	20Ch	SL
Setpoint 2	25	19h	525	20Dh	S2
Remote setpoint	26	1Ah	526	20Eh	SR
Local setpoint trim	27	1Bh	527	20Fh	LT
Manual reset	28	1Ch	528	210h	MR
Cycle time - channel 2	29	1Dh	529	211h	CC
High power limit - channel 1	30	1Eh	530	212h	HO
High power limit - channel 2	31	1Fh	531	213h	LO
Working setpoint high limit	32	20h	532	214h	HS
Working setpoint low limit	33	21h	533	215h	LS
Sensor break power	34	22h	534	216h	BP

Loop parameters - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Working setpoint rate limit	35	23h	535	217h	RR
DRA trigger value	36	24h	536	218h	AT
Pyrometer emissivity	37	25h	537	219h	PE
Error value PV - SP	38	26h	538	21Ah	ER
Setpoint 2 high limit	39	27h	539	21Bh	H2
Setpoint 2 low limit	40	28h	540	21Ch	L2
Minimum response time - channel 1	41	29h	541	21Dh	MT
Output - channel 1	42	2Ah	542	21Eh	O1
Output - channel 2	43	2Bh	543	21Fh	O2
Remote input sensor break value	44	2Ch	544	220h	RD
Remote setpoint trim	45	2Dh	545	221h	RT
Remote high power or manual value	46	2Eh	546	222h	RV
Remote high power limit	47	2Fh	547	223h	RH
Transducer scaling gain	48	30h	548	224h	PM
Transducer scaling offset	49	31h	549	225h	PO
Feedforward value	50	32h	550	226h	FF
Loop status word (see SWD)	51	33h	551	227h	WL
Gain scheduling: set 1 cutback high	52	34h	552	228h	GS
Gain scheduling: set 1 proportional band	53	35h	553	229h	GS
Gain scheduling: set 1 integral time	54	36h	554	22Ah	GS
Gain scheduling: set 1 derivative time	55	37h	555	22Bh	GS
Gain scheduling: set 1 cutback low	56	38h	556	22Ch	GS
Gain scheduling: set 1 relative op 2 gain	57	39h	557	22Dh	GS
Gain scheduling: reschéduling boundary 1	58	3Ah	558	22Eh	GS
Gain scheduling: set 2 cutback high	59	3Bh	559	22Fh	GS
Gain scheduling: set 2 proportional band	60	3Ch	560	230h	GS
Gain scheduling: set 2 integral time	61	3Dh	561	231h	GS
Gain scheduling: set 2 derivative time	62	3Eh	562	232h	GS
Gain scheduling: set 2 cutback low	63	3Fh	563	233h	GS
Gain scheduling: set 2 relative op 2 gain	64	40h	564	234h	GS
Gain scheduling: rescheduling boundary 2	65	41h	565	235h	GS
Gain scheduling: set 3 cutback high	66	42h	566	236h	GS
Gain scheduling: set 3 proportional band	67	43h	567	237h	GS
Gain scheduling: set 3 integral time	68	44h	568	238h	GS
Gain scheduling: set 3 derivative time	69	45h	569	239h	GS
Gain scheduling: set 3 cutback low	70	46h	570	23Ah	GS
Gain scheduling: set 3 relative op 2 gain	71	47h	571	23Bh	GS
Gain scheduling: rescheduling boundary 3	72	48h	572	23Ch	GS
Gain scheduling: set 4 cutback high	73	49h	573	23Dh	GS
Gain scheduling: set 4 proportional band	74	4Ah	574	23Eh	GS
Gain scheduling: set 4 integral time	75	4Bh	575	23Fh	GS
Gain scheduling: set 4 derivative time	76	4Ch	576	240h	GS
Gain scheduling: set 4 cutback low	77	4Dh	577	241h	GS
Gain scheduling: set 4 relative op 2 gain	78	4Eh	578	242h	GS
Gain scheduling: rescheduling boundary 4	79	4Fh	579	243h	GS
Gain scheduling: set 5 cutback high	80	50h	580	244h	GS

Loop parameters - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Gain scheduling: set 5 proportional band	81	51h	581	245h	GS
Gain scheduling: set 5 integral time	82	52h	582	246h	GS
Gain scheduling: set 5 derivative time	83	53h	583	247h	GS
Gain scheduling: set 5 cutback low	84	54h	584	248h	GS
Gain scheduling: set 5 relative op 2 gain	85	55h	585	249h	GS
Remote low power limit	86	56h	586	24Ah	RL
Scroll list function access contrl (see SWD)	87	57h	587	24Bh	WF
Level 1 page access control (see SWD)	88	58h	588	24Ch	WJ
Valve position high limit - channel 1	90	5Ah	590	24Eh	VH
Valve position low limit - channel 1	91	5Bh	591	24Fh	VL
Forced output value	92	5Ch	592	250h	FO
Valve position - channel 1	93	5Dh	593	251h	VF
Valve position - channel 2	94	5Eh	594	252h	Vf
Valve position high limit - channel 2	95	5Fh	595	253h	Vh
Valve position low limit - channel 2	96	60h	596	254h	Vl
Requested valve action - channel 2 (as 4)	97	61h	597	255h	V2
Channel 2 forced output	98	62h	598	256h	2F
VP control sensor break action ch 2 (as 22)	99	63h	599	257h	Bv
Minimum response time - channel 2	100	64h	600	258h	M2
Motor travel time - channel 2	101	65h	601	259h	Tt
Auto tune high power limit	102	66h	602	25Ah	AH
Auto tune low power limit	103	67h	603	25Bh	AL
Active gain scheduling set	104	68h	604	25Ch	GD
Gain scheduling: set 1 high power limit	105	69h	605	25Dh	GS
Gain scheduling: set 2 high power limit	106	6Ah	606	25Eh	GS
Gain scheduling: set 3 high power limit	107	6Bh	607	25Fh	GS
Gain scheduling: set 4 high power limit	108	6Ch	608	260h	GS
Gain scheduling: set 5 high power limit	109	6Dh	609	261h	GS
Gain scheduling: set 1 low power limit	110	6Eh	610	262h	GS
Gain scheduling: set 2 low power limit	111	6Fh	611	263h	GS
Gain scheduling: set 3 low power limit	112	70h	612	264h	GS
Gain scheduling: set 4 low power limit	113	71h	613	265h	GS
Gain scheduling: set 5 low power limit	114	72h	614	266h	GS
Low power limit - channel 1	115	73h	615	267h	MO
Active gain scheduling high power limit	116	74h	616	268h	
Active gain scheduling low power limit	117	75h	617	269h	
Gravimetric blend ratio	118	76h	618	26Ah	GR
Gravimetric empty hopper output value	119	77h	619	26Bh	GE
Gravimetric delta time	120	78h	620	26Ch	GT
Gravimetric delta weight	121	79h	621	26Dh	GM
Gravimetric post calibration factor	122	7Ah	622	26Eh	GC
Gravimetric flow rate filter time constant	123	7Bh	623	26Fh	Gf
Gravimetric output in RPM	124	7Ch	624	270h	GO
Gravimetric material bulk density	125	7Dh	625	271h	GK
Gravimetric hopper absolute full weight kg	126	7Eh	626	272h	GF

Loop parameters - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Gravimetric adaptive fill status 0 Inactive 1 Active	127	7Fh	627	273h	GY
Gravimetric hopper empty alarm 0 False 1 True	129	81h	629	275h	Ge
Gravimetric valve state 0 Closed 1 Open	130	82h	630	276h	GV
Startup strategy 0 No change 1 Set output power level	131	83h	631	277h	SU
Output power at startup	132	84h	632	278h	SO
Gravimetric weight	133	85h	633	279h	
PV feedforward trim	134	86h	634	27Ah	FP
Setpoint feedforward trim	135	87h	635	27Bh	SF

Loop diagnostic parameters

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Process input measured value	401	191h	901	385h	1M
RT lead resistance	402	192h	902	386h	2M
Remote input measured value	403	193h	903	387h	3M
CJC value	404	194h	904	388h	CJ
Process input linearised value	405	195h	905	389h	LI
Remote input linearised value	406	196h	906	38Ah	LR
Normalised error	407	197h	907	38Bh	NE
Integral output	408	198h	908	38Ch	IO
Derivative output	409	199h	909	38Dh	DP
Current autotune stage	412	19Ch	912	390h	AS
0 Autotune reset					
1 Autotune initialisation					
2 Monitor quiescent noise					
3 End of monitor noise					
4 Start up with new setpoint					
5 End start up with new setpoint					
6 Start up with PV at setpoint					
7 End start up with PV at setpoint					
8 Ziegler nichols sequence					
9 Calculate new parameters					
10 Writing update status					
11 Debump PID change					
12 Autotune aborted					
13 Autotune complete					
Current Ziegler Nichols stage	413	19Dh	913	391h	ZN
0 Initialisation					
1 Find peek PV & reverse output					
2 Find PV crossing PV1					
3 Find peek PV & reverse output					
4 PV cross PV1, test dominant delay					
5 Peek PV, reverse o/p or PV change					
6 Find PV cross PV1, adj trend & o/p					
7 Find peek PV & reverse output					
8 Find PV cross & calculate params					

Loop diagnostic parameters - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Current DRA stage	414	19Eh	914	392h	DS
0 Allow settling					
1 Wait for trigger					
2 Find peak 1					
3 Find zero 1					
4 Find peak 2					
5 Find zero 2					
6 Find peak 3					
7 Find zero 3					
8 Find peak 4					
9 Find zero 4					
10 Find peak 5					
11 End on zero 4 abort					
12 End on peak 4 abort					
13 End on peak 5 abort					
14 End on peak 5 found					
15 Prepare update					
Last DRA tuning strategy	415	19Fh	915	393h	DL
0 Not adapted					
1 Reduced damping					
2 Increased gain					
3 Decreased times					
4 Increased times					
5 Decreased gain					
Detuning factor	416	1A0h	916	394h	DF
Process delay time	417	1A1h	917	395h	DT
Load time constant	418	1A2h	918	396h	LC
Tuning sample time	419	1A3h	919	397h	TS
Valve position module measured value	420	1A4h	920	398h	4M
LSAT diagnostic parameter	421	1A5h	921	399h	

General parameters

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Instrument mode 0 Instrument in operational mode 1 Instrument in standby mode 2 Instrument in configuration mode 5 Instrument in security mode	2001	7D1h	N/A	N/A	IM
JBUS node address	2002	7D2h	N/A	N/A	JA
Instrument status word (see SWD)	2003	7D3h	N/A	N/A	WS
Digital input status 16 MSBs (see SWD)	2004	7D4h	N/A	N/A	WI
Digital input status 16 LSBs (see SWD)	2005	7D5h	N/A	N/A	WI
Digital output status 16 MSBs (see SWD)	2006	7D6h	N/A	N/A	WO
Digital output status 16 LSBs (see SWD)	2007	7D7h	N/A	N/A	WO
Analogue telemetry input 1	2008	7D8h	N/A	N/A	AI
Analogue telemetry input 2	2009	7D9h	N/A	N/A	AI
Analogue telemetry input 3	2010	7DAh	N/A	N/A	AI
Analogue telemetry input 4	2011	7DBh	N/A	N/A	AI
Analogue telemetry input 5	2012	7DCh	N/A	N/A	AI
Analogue telemetry input 6	2013	7DDh	N/A	N/A	AI
Analogue telemetry input 7	2014	7DEh	N/A	N/A	AI
Analogue telemetry input 8	2015	7DFh	N/A	N/A	AI
Analogue telemetry output 1	2016	7E0h	N/A	N/A	AO
Analogue telemetry output 2	2017	7E1h	N/A	N/A	AO
Analogue telemetry output 3	2018	7E2h	N/A	N/A	AO
Analogue telemetry output 4	2019	7E3h	N/A	N/A	AO
Analogue telemetry output 5	2020	7E4h	N/A	N/A	AO
Analogue telemetry output 6	2021	7E5h	N/A	N/A	AO
Digital telemetry input 1	2022	7E6h	N/A	N/A	DI
Digital telemetry input 2	2023	7E7h	N/A	N/A	DI
Digital telemetry input 3	2024	7E8h	N/A	N/A	DI
Digital telemetry input 4	2025	7E9h	N/A	N/A	DI
Digital telemetry input 5	2026	7EAh	N/A	N/A	DI
Digital telemetry input 6	2027	7EBh	N/A	N/A	DI
Digital telemetry input 7	2028	7ECh	N/A	N/A	DI
Digital telemetry input 8	2029	7EDh	N/A	N/A	DI
Digital telemetry output 1	2030	7EEh	N/A	N/A	DO
Digital telemetry output 2	2031	7EFh	N/A	N/A	DO
Digital telemetry output 3	2032	7F0h	N/A	N/A	DO
Digital telemetry output 4	2033	7F1h	N/A	N/A	DO
Digital telemetry output 5	2034	7F2h	N/A	N/A	DO
Digital telemetry output 6	2035	7F3h	N/A	N/A	DO
Level 2 password	2036	7F4h	N/A	N/A	P2
Level 3 password	2037	7F5h	N/A	N/A	P3
Configuration password	2038	7F6h	N/A	N/A	PC
Working ratio setpoint	2039	7F7h	N/A	N/A	RW
Ratio setpoint 1	2040	7F8h	N/A	N/A	RS
Ratio setpoint 2	2041	7F9h	N/A	N/A	2R
Remote ratio setpoint trim	2042	7FAh	N/A	N/A	TR

General parameters - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Ratio bias	2043	7FBh	N/A	N/A	RB
Ratio setpoint high limit	2044	7FCh	N/A	N/A	HA
Ratio setpoint low limit	2045	7FDh	N/A	N/A	LA
Real time clock control 0 Clock running 1 Clock stopped 2 Clock alterable 3 Clock stopped	2047	7FFh	N/A	N/A	SC
Real time clock - day 1 Monday 2 Tuesday 3 Wednesday 4 Thursday 5 Friday 6 Saturday 7 Sunday	2048	800h	N/A	N/A	tm
Real time clock - hour (0 to 23)	2049	801h	N/A	N/A	tm
Real time clock - min (0 to 59)	2050	802h	N/A	N/A	tm
Real time clock - secs (0 to 59)	2051	803h	N/A	N/A	tm
Instrument baud rate 0 9600 baud 1 4800 baud 2 2400 baud 3 1200 baud 4 300 baud	2056	808h	N/A	N/A	br
Bi-synch instrument node address	2057	809h	N/A	N/A	na
Alarm 1 setpoint	2058	80Ah	N/A	N/A	A1
Alarm 2 setpoint	2059	80Bh	N/A	N/A	A2
Alarm 3 setpoint	2060	80Ch	N/A	N/A	A3
Alarm 4 setpoint	2061	80Dh	N/A	N/A	A4
Alarm 1 delay	2062	80Eh	N/A	N/A	D1
Alarm 2 delay	2063	80Fh	N/A	N/A	D2
Alarm 3 delay	2064	810h	N/A	N/A	D3
Alarm 4 delay	2065	811h	N/A	N/A	D4
Alarm status word (see SWD)	2066	812h	N/A	N/A	WA
Pulse burner minimum cycle time	2067	813h	N/A	N/A	CM
Pulse burner 1 on time	2068	814h	N/A	N/A	1T
Pulse burner 2 on time	2069	815h	N/A	N/A	2T
Pulse burner 3 on time	2070	816h	N/A	N/A	3T
Pulse burner 4 on time	2071	817h	N/A	N/A	4T
Pulse burner 5 on time	2072	818h	N/A	N/A	5T
Pulse burner 6 on time	2073	819h	N/A	N/A	6T
Pulse burner 7 on time	2074	81Ah	N/A	N/A	7T
Pulse burner 8 on time	2075	81Bh	N/A	N/A	8T
Totaliser 1 trigger level	2076	81Ch	N/A	N/A	1A
Totaliser 2 trigger level	2077	81Dh	N/A	N/A	2A

General parameters - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Totaliser 3 trigger level	2078	81Eh	N/A	N/A	3A
Totaliser 4 trigger level	2079	81Fh	N/A	N/A	4A
Totaliser 1 accumulated value	2080	820h	N/A	N/A	I1
Totaliser 2 accumulated value	2081	821h	N/A	N/A	I2
Totaliser 3 accumulated value	2082	822h	N/A	N/A	I3
Totaliser 4 accumulated value	2083	823h	N/A	N/A	I4
Totaliser status word (see SWD)	2084	824h	N/A	N/A	WT
User value 1	2085	825h	N/A	N/A	C1
User value 2	2086	826h	N/A	N/A	C2
User value 3	2087	827h	N/A	N/A	C3
User value 4	2088	828h	N/A	N/A	C4
Calculated value 1	2089	829h	N/A	N/A	W1
Calculated value 2	2090	82Ah	N/A	N/A	W2
Calculated value 3	2091	82Bh	N/A	N/A	W3
Calculated value 4	2092	82Ch	N/A	N/A	W4
Calculated value 5	2093	82Dh	N/A	N/A	W5
Calculated value 6	2094	82Eh	N/A	N/A	W6
Calculated value 7	2095	82Fh	N/A	N/A	W7
Calculated value 8	2096	830h	N/A	N/A	W8
User switch 0 Zero (off) 1 One (on)	2097	831h	N/A	N/A	Z1
User switch 2 (as 2097)	2098	832h	N/A	N/A	Z2
User switch 3 (as 2097)	2099	833h	N/A	N/A	Z3
User switch 4 (as 2097)	2100	834h	N/A	N/A	Z4
Prog logic register status word (see SWD)	2101	835h	N/A	N/A	WB
Level 2 page access control (see SWD)	2102	836h	N/A	N/A	WK
Alarm 1 entry time - hour (0 to 23)	2103	837h	N/A	N/A	E1
Alarm 1 entry time - min (0 to 59)	2104	838h	N/A	N/A	E1
Alarm 2 entry time - hour (0 to 23)	2105	839h	N/A	N/A	E2
Alarm 2 entry time - min (0 to 59)	2106	83Ah	N/A	N/A	E2
Alarm 3 entry time - hour (0 to 23)	2107	83Bh	N/A	N/A	E3
Alarm 3 entry time - min (0 to 59)	2108	83Ch	N/A	N/A	E3
Alarm 4 entry time - hour (0 to 23)	2109	83Dh	N/A	N/A	E4
Alarm 4 entry time - min (0 to 59)	2110	83Eh	N/A	N/A	E4
Time in alarm 1	2111	83Fh	N/A	N/A	R1
Time in alarm 2	2112	840h	N/A	N/A	R2
Time in alarm 3	2113	841h	N/A	N/A	R3
Time in alarm 4	2114	842h	N/A	N/A	R4
Wet bulb correction	2115	843h	N/A	N/A	HT
Gas correction	2116	844h	N/A	N/A	CO
Zirconia probe millivolts	2117	845h	N/A	N/A	OM
Zirconia probe temperature	2118	846h	N/A	N/A	OT
Lead value	2119	847h	N/A	N/A	Lv

General parameters - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Timer 1 on time - day 0 All 1 Monday 2 Tuesday 3 Wednesday 4 Thursday 5 Friday 6 Saturday 7 Sunday 8 Mon to Friday	2121	849h	N/A	N/A	DE
Timer 1 on time - hour (0 to 23)	2122	84Ah	N/A	N/A	DE
Timer 1 on time - min (0 to 59)	2123	84Bh	N/A	N/A	DE
Timer 1 off time - day (as 2121)	2124	84Ch	N/A	N/A	DX
Timer 1 off time - hour (0 to 23)	2125	84Dh	N/A	N/A	DX
Timer 1 off time - min (0 to 59)	2126	84Eh	N/A	N/A	DX
Timer 1 delay time (seconds)	2127	84Fh	N/A	N/A	d1
Timer 1 elapsed time (seconds)	2128	850h	N/A	N/A	
Timer 1 enable (as 2097)	2129	851h	N/A	N/A	1O
Timer 1 status 0 Waiting 1 Triggered (timing) 2 Actioning (timing complete)	2130	852h	N/A	N/A	
Timer 2 on time - day (as 2121)	2131	853h	N/A	N/A	2E
Timer 2 on time - hour (0 to 23)	2132	854h	N/A	N/A	2E
Timer 2 on time - min (0 to 59)	2133	855h	N/A	N/A	2E
Timer 2 stop time - day (as 2121)	2134	856h	N/A	N/A	2X
Timer 2 stop time - hour (0 to 23)	2135	857h	N/A	N/A	2X
Timer 2 stop time - min (0 to 59)	2136	858h	N/A	N/A	2X
Timer 2 delay time (seconds)	2137	859h	N/A	N/A	d2
Timer 2 elapsed time (seconds)	2138	85Ah	N/A	N/A	
Timer 2 enable (as 2097)	2139	85Bh	N/A	N/A	2O
Timer 2 status (as 2130)	2140	85Ch	N/A	N/A	
Timer 3 on time - day (as 2121)	2141	85Dh	N/A	N/A	3E
Timer 3 on time - hour (0 to 23)	2142	85Eh	N/A	N/A	3E
Timer 3 on time - min (0 to 59)	2143	85Fh	N/A	N/A	3E
Timer 3 off time - day (as 2121)	2144	860h	N/A	N/A	3X
Timer 3 off time - hour (0 to 23)	2145	861h	N/A	N/A	3X
Timer 3 off time - min (0 to 59)	2146	862h	N/A	N/A	3X
Timer 3 delay time (seconds)	2147	863h	N/A	N/A	d3
Timer 3 elapsed time (seconds)	2148	864h	N/A	N/A	
Timer 3 enable (as 2097)	2149	865h	N/A	N/A	3O
Timer 3 status (as 2130)	2150	866h	N/A	N/A	
Timer 4 on time - day (as 2121)	2151	867h	N/A	N/A	4E
Timer 4 on time - hour (0 to 23)	2152	868h	N/A	N/A	4E
Timer 4 on time - min (0 to 59)	2153	869h	N/A	N/A	4E
Timer 4 off time - day (as 2121)	2154	86Ah	N/A	N/A	4X

General parameters - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Timer 4 off time - hour (0 to 23)	2155	86Bh	N/A	N/A	4X
Timer 4 off time - min (0 to 59)	2156	86Ch	N/A	N/A	4X
Timer 4 delay time (seconds)	2157	86Dh	N/A	N/A	d4
Timer 4 elapsed time (seconds)	2158	86Eh	N/A	N/A	
Timer 4 enable (as 2097)	2159	86Fh	N/A	N/A	4O
Timer 4 status (as 2130)	2160	870h	N/A	N/A	
Timer status word (see SWD)	2161	871h	N/A	N/A	WE
Alarm 1 exit time - hour (0 to 23)	2162	872h	N/A	N/A	X1
Alarm 1 exit time - min (0 to 59)	2163	873h	N/A	N/A	X1
Alarm 2 exit time - hour (0 to 23)	2164	874h	N/A	N/A	X2
Alarm 2 exit time - min (0 to 59)	2165	875h	N/A	N/A	X2
Alarm 3 exit time - hour (0 to 23)	2166	876h	N/A	N/A	X3
Alarm 3 exit time - min (0 to 59)	2167	877h	N/A	N/A	X3
Alarm 4 exit time - hour (0 to 23)	2168	878h	N/A	N/A	X4
Alarm 4 exit time - min (0 to 59)	2169	879h	N/A	N/A	X4
Gravi blend ratio status 0 Inactive 1 Active	2170	87Ah	N/A	N/A	GX
Calculated value status word (see SWD)	2203	89B	N/A	N/A	WC

General diagnostic parameters

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
68070 software version	2901	B55h	N/A	N/A	V0
Instrument identity (=9050 for 900 EPC)	2902	B56h	N/A	N/A	II
Communications error code	2903	B57h	N/A	N/A	EE
Error log item 1 (The most recent error)	2904	B58h	N/A	N/A	IE
0 No log error					
1 Watchdog error					
2 Software watchdog error					
3 Uninitialised interrupt error					
4 Configuration data checksum error					
5 Nonvol memory read access error					
6 Nonvol memory write access error					
7 Nonvol memory test corruption					
8 RAM test pattern corruption error					
9 Stack error					
10 ASIC 1 error					
11 RTC error					
12 SPI bus failure					
13 50ms tasks too slow					
14 Calibration value out of limits					
15 I2C bus failure					
16 Low battery					
17 VP position pot open loop 1 (oc => 127)					
18 VP position pot short loop 1 (sc => 0)					
19 VP position pot open loop 2 (oc => 127)					
20 VP position pot short loop 2 (sc => 0)					
21 PV input overrange loop 1 (break)					
22 PV input underrange loop 1 (break)					
23 PV ip eids not ready loop 1 (reset)					
24 PV ip 6805 not ready loop 1 (reset)					
25 PV input overrange loop 2 (break)					
26 PV input underrange loop 2 (break)					
27 PV ip eids not ready loop 2 (reset)					
28 PV ip 6805 not ready loop 2 (reset)					
29 Remote ip overrange loop 1 (break)					
30 Remote ip underrange loop 1 (break)					
31 Rem ip eids not ready loop 1 (break)					
32 Rem ip 6805 not ready lop 1 (break)					
33 Remote ip overrange loop 2 (break)					
34 Remote ip underrange loop 2 (break)					
35 Rem ip eids not ready loop 2 (break)					
36 Rem ip 6805 not ready lop 2 (break)					
37 PV input eids selftest failure loop 1					
38 PV input timer selftest failure loop 1					
39 PV input rom selftest failure loop 1					
40 PV input eids selftest failure loop 2					
41 PV input timer selftest failure loop 2					

General diagnostic parameters - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
42 PV input rom selftest failure loop 2 43 Remote ip eids selftest failure loop 1 44 Remote ip timer selftest failure lop 1 45 Remote ip rom selftest failure loop 1 46 Remote ip eids selftest failure loop 2 47 Remote ip timer selftest failure lop 2 48 Remote ip rom selftest failure loop 2					
Error log item 2 (as 2904)	2905	B59h	N/A	N/A	IE
Error log item 3 (as 2904)	2906	B5Ah	N/A	N/A	IE
Error log item 4 (as 2904)	2907	B5Bh	N/A	N/A	IE
Error log item 5 (as 2904)	2908	B5Ch	N/A	N/A	IE
Error log item 6 (as 2904)	2909	B5Dh	N/A	N/A	IE
Error log item 7 (as 2904)	2910	B5Eh	N/A	N/A	IE
Error log item 8 (as 2904)	2911	B5Fh	N/A	N/A	IE
Error log item 9 (as 2904)	2912	B60h	N/A	N/A	IE
Error log item 10 (as 2904)	2913	B61h	N/A	N/A	IE
Error log item 11 (as 2904)	2914	B62h	N/A	N/A	IE
Error log item 12 (as 2904)	2915	B63h	N/A	N/A	IE
Error log item 13 (as 2904)	2916	B64h	N/A	N/A	IE
Error log item 14 (as 2904)	2917	B65h	N/A	N/A	IE
Error log item 15 (as 2904)	2918	B66h	N/A	N/A	IE
Error log item 16, the 16th error (as 2904)	2919	B67h	N/A	N/A	IE
Clear error log (1 clear error log)	2920	B68h	N/A	N/A	ce
Error address	2921	B69h	N/A	N/A	ea
Error vector	2922	B6Ah	N/A	N/A	ev
Comms keys (only available if bit 6 of SW is set) 1 key 1 2 key 2 3 key 3 4 key 4 5 key 5 6 key 6	2923	B6Bh	N/A	N/A	ck
Power feedback value	2924	B6Ch	N/A	N/A	PF

Configuration parameters

Process input configuration

Parameter Description		Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
		dec	hex	dec	hex	
Process input linearisation definition		3001	BB9h	3007	BBFh	pi
0	None					
1	J thermocouple (01)					
2	L thermocouple (02)					
3	K thermocouple (03)					
4	T thermocouple (04)					
5	R thermocouple (05)					
6	S thermocouple (06)					
7	B thermocouple (08)					
8	W/W 26 Eng. thermocouple (29)					
9	W5W 26 Eng. thermocouple (24)					
10	E thermocouple (12)					
11	P10/40 RHS thermocouple (23)					
12	C thermocouple (24)					
13	R20/40 RH thermocouple (25)					
14	Platinell thermocouple (28)					
15	G2 W/WRe26% thermocouple (29)					
16	Ni/NI18%Moly thermocouple (33)					
17	Moly5%Re/Moly41%Re T/C (34)					
18	W3W 25 HER thermocouple (35)					
19	W5W 26 BIC thermocouple (38)					
20	N Nilsil thermocouple (45)					
21	Q004 pyrometer (48)					
22	Q003 pyrometer (51)					
23	RO 26 ORK 35-2-3 pyrometer (54)					
24	IVD1 pyrometer (61)					
25	DT1 pyrometer (62)					
26	RO23 pyrometer (64)					
27	FP/GP 10 pyrometer (82)					
28	FP/GP 11 pyrometer (83)					
29	FP/GP 12 pyrometer (84)					
30	FP/GP 20 pyrometer (85)					
31	FP/GP 21 pyrometer (86)					
32	RT100 (70)					
33	JIS 100 (78)					
34	Square root (92)					
35	Linear					
36	Customised without CJC					
37	Customised with CJC					
38	Customised with emissivity					
39	Characterised					
Process input input range units		3002	BBAh	3008	BC0h	pi
0	Process input units mV					
1	Process input units V					
2	Process input units mA					

Process input configuration - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Display resolution	3003	BBBh	3009	BC1h	pi
0 0 decimal places					
1 1 decimal places					
2 2 decimal places					
3 3 decimal places					
Characterisation type	3004	BBCh	3010	BC2h	pi
0 None					
1 J thermocouple (01)					
2 L thermocouple (02)					
3 K thermocouple (03)					
4 T thermocouple (04)					
5 R thermocouple (05)					
6 S thermocouple (06)					
7 B thermocouple (08)					
8 W/W 26 Eng. thermocouple (29)					
9 W5W 26 Eng. thermocouple (24)					
10 E thermocouple (12)					
11 P10/40 RHS thermocouple (23)					
12 C thermocouple (24)					
13 R20/40 RH thermocouple (25)					
14 Platinell thermocouple (28)					
15 G2 W/WRe26% thermocouple (29)					
16 Ni/NI18%Moly thermocouple (33)					
17 Moly5%Re/Moly41%Re T/C (34)					
18 W3W 25 HER thermocouple (35)					
19 W5W 26 BIC thermocouple (38)					
20 N Nilsil thermocouple (45)					
21 Q004 pyrometer (48)					
22 Q003 pyrometer (51)					
23 RO 26 ORK 35-2-3 pyrometer (54)					
24 IVD1 pyrometer (61)					
25 DT1 pyrometer (62)					
26 RO23 pyrometer (64)					
27 FP/GP 10 pyrometer (82)					
28 FP/GP 11 pyrometer (83)					
29 FP/GP 12 pyrometer (84)					
30 FP/GP 20 pyrometer (85)					
31 FP/GP 21 pyrometer (86)					
32 RT100 (70)					
33 JIS 100 (78)					
Process input input range maximum	3005	BBDh	3011	BC3h	pi
Process input input range minimum	3006	BBEh	3012	BC4h	pi
Process input display high limit	3013	BC5h	3015	BC7h	1H
Process input display low limit	3014	BC6h	3016	BC8h	1L

Remote input configuration

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Remote input linearisation definition	3017	BC9h	3023	BCFh	ri
0 None					
1 J thermocouple (01)					
2 L thermocouple (02)					
3 K thermocouple (03)					
4 T thermocouple (04)					
5 R thermocouple (05)					
6 S thermocouple (06)					
7 B thermocouple (08)					
8 W/W 26 Eng. thermocouple (29)					
9 W5W 26 Eng. thermocouple (24)					
10 E thermocouple (12)					
11 P10/40 RHS thermocouple (23)					
12 C thermocouple (24)					
13 R20/40 RH thermocouple (25)					
14 Platinell thermocouple (28)					
15 G2 W/WRe26% thermocouple (29)					
16 Ni/NI18%Moly thermocouple (33)					
17 Moly5%Re/Moly41%Re T/C (34)					
18 W3W 25 HER thermocouple (35)					
19 W5W 26 BIC thermocouple (38)					
20 N Nilsil thermocouple (45)					
21 Q004 pyrometer (48)					
22 Q003 pyrometer (51)					
23 RO 26 ORK 35-2-3 pyrometer (54)					
24 IVD1 pyrometer (61)					
25 DT1 pyrometer (62)					
26 RO23 pyrometer (64)					
27 FP/GP 10 pyrometer (82)					
28 FP/GP 11 pyrometer (83)					
29 FP/GP 12 pyrometer (84)					
30 FP/GP 20 pyrometer (85)					
31 FP/GP 21 pyrometer (86)					
32 RT100 (70)					
33 JIS 100 (78)					
34 Square root (92)					
35 Linear					
36 Customised without CJC					
Remote input units	3018	BCAh	3024	BD0h	ri
1 Remote input units V					
2 Remote input units mA					
Remote input input range maximum	3019	BCBh	3025	BD1h	ri
Remote input input range minimum	3020	BCCh	3026	BD2h	ri
Remote input display range maximum	3021	BCDh	3027	BD3h	ri
Remote input display range minimum	3022	BCEh	3028	BD4h	ri

I/O slot occupancy configuration

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
I/O slot 1 occupancy	3029	BD5h	N/A	N/A	id
0 I/O slot empty					
1 Single relay module					
2 Single logic module					
3 Single triac module					
4 DC control module					
5 DC input module					
6 V.P. pot. position input module					
7 Dual relay module					
8 Dual relay with load sense module					
9 Quad logic input module					
10 Quad logic output module					
11 Triple logic output module					
12 Transducer power supply module					
13 Digital communication module					
14 Dual triac module					
15 Dual triac with load sense module					
16 DC retrans module					
17 Dual relay with op mutual exclusion					
18 Dual triac with op mutual exclusion					
19 Invalid ident					
I/O slot 2 occupancy (as 3029)	3030	BD6h	N/A	N/A	id
I/O slot 3 occupancy (as 3029)	3031	BD7h	N/A	N/A	id
I/O slot 4 occupancy (as 3029)	3032	BD8h	N/A	N/A	id
I/O slot 5 occupancy (as 3029)	3033	BD9h	N/A	N/A	id
I/O slot 6 occupancy (as 3029)	3034	BDAh	N/A	N/A	id

Logic I/O function configuration

The 900 EPC provides two digital inputs with the standard instrument. The six I/O slots may be fitted with a variety of input and output modules. Each I/O module may have up to four separate functions, (for example, a quad logic input module). The function of each input/output is defined by the numbers in the list on the next few pages. The functions are sub divided as follows;

0 to 117 Logic input functions
118 to 208 Logic output functions
203 to 226 DC control or re transmission functions
227 to 246 DC input functions
247 to 254 Valve positioner functions

The JBUS addresses of the logic I/O function configuration are in the table below.

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
I/O slot 1 1st function configuration	3035	BDBh	N/A	N/A	sf
I/O slot 1 2nd function configuration	3036	BDCh	N/A	N/A	sf
I/O slot 1 3rd function configuration	3037	BDDh	N/A	N/A	sf
I/O slot 1 4th function configuration	3038	BDEh	N/A	N/A	sf
I/O slot 2 1st function configuration	3039	BDFh	N/A	N/A	sf
I/O slot 2 2nd function configuration	3040	BE0h	N/A	N/A	sf
I/O slot 2 3rd function configuration	3041	BE1h	N/A	N/A	sf
I/O slot 2 4th function configuration	3042	BE2h	N/A	N/A	sf
I/O slot 3 1st function configuration	3043	BE3h	N/A	N/A	sf
I/O slot 3 2nd function configuration	3044	BE4h	N/A	N/A	sf
I/O slot 3 3rd function configuration	3045	BE5h	N/A	N/A	sf
I/O slot 3 4th function configuration	3046	BE6h	N/A	N/A	sf
I/O slot 4 1st function configuration	3047	BE7h	N/A	N/A	sf
I/O slot 4 2nd function configuration	3048	BE8h	N/A	N/A	sf
I/O slot 4 3rd function configuration	3049	BE9h	N/A	N/A	sf
I/O slot 4 4th function configuration	3050	BEAh	N/A	N/A	sf
I/O slot 5 1st function configuration	3051	BEBh	N/A	N/A	sf
I/O slot 5 2nd function configuration	3052	BECh	N/A	N/A	sf
I/O slot 5 3rd function configuration	3053	BEDh	N/A	N/A	sf
I/O slot 5 4th function configuration	3054	BEEh	N/A	N/A	sf
I/O slot 6 1st function configuration	3055	BEFh	N/A	N/A	sf
I/O slot 6 2nd function configuration	3056	BF0h	N/A	N/A	sf
I/O slot 6 3rd function configuration	3057	BF1h	N/A	N/A	sf
I/O slot 6 4th function configuration	3058	BF2h	N/A	N/A	sf
Digital input 1 function configuration	3059	BF3h	N/A	N/A	di
Digital input 2 function configuration	3060	BF4h	N/A	N/A	di

Logic Input Functions

0 No logic input function
1 Auto/Manual loop 1
2 Remote enable loop 1
3 Setpoint 2 enable loop 1
4 Setpoint rate limit enable loop 1
5 Freeze integral action on loop 1
6 Output rate limit enable loop 1
7 Autotune enable loop 1
8 Adaptive tune enable loop 1
9 Gain scheduling enable loop 1
10 Ratio enable
11 Ratio setpoint 2 enable
12 Cascade enable
13 Auto/Manual loop 2
14 Remote enable loop 2
15 Setpoint 2 enable loop 2
16 Setpoint rate limit enable loop 2
17 Freeze integral action on loop 2
18 Output rate limit enable loop 2
19 Autotune enable loop 2
20 Adaptive tune enable loop 2
21 Gain scheduling enable loop 2
22 Auto/Manual both loops
23 Remote enable both loops
24 Setpoint 2 both loops
25 Setpoint rate limit enable both loops
26 Freeze integral both loops
27 Output rate limit both loops
28 Autotune enable both loops
29 Adaptive tune enable both loops
30 Gain scheduling enable both loops
31 Keylock enable
32 Use input 2
33 Digital comms disable
34 Digital re transmission disable
35 Broadcast disable
36 Standby mode enable
37 Timer disable
38 Timer 1 enable
39 Timer 2 enable
40 Timer 3 enable
41 Timer 4 enable
42 Setpoint 1 loop 1
43 Setpoint 1 loop 2
44 Setpoint 1 both loops
45 Alarm acknowledge
46 Telemetry digital input
47 Reset totaliser 1
48 Reset totaliser 2
49 Reset totaliser 3
50 Reset totaliser 4
51 reset all totalisers
52 Run
53 Reset
54 Hold
55 Run/Hold
56 Run/Reset
57 Hold/Run
58 Holdback disable
59 Loop 1 skip current segment
60 Loop 2 skip current segment
61 Skip current segment both loops
62 Loop 1 wait until
63 Loop 2 wait until
64 Both loops wait until
65 Load program loop 1
66 Load program loop 2
67 Load program both loops
68 Loop 1 LS. digit of program no.
69 Loop 1 2nd LS. digit of program no.
70 Loop 1 3rd LS. digit of program no.
71 Loop 1 MS. digit of program no.
72 Loop 2 LS. digit of program no.
73 Loop 2 2nd LS. digit of program no.
74 Loop 2 3rd LS. digit of program no.
75 Loop 2 MS. digit of program no.
76 LS. digit of program no. both loops
77 2nd LS. digit of program no. both loops
78 3rd LS. digit of program no. both loops
79 MS. digit of program no. both loops
80 Loop 1 BCD1 of program no.
81 Loop 1 BCD2 of program no.
82 Loop 1 BCD3 of program no.
83 Loop 1 BCD4 of program no.
84 Loop 1 BCD5 of program no.
85 Loop 1 BCD6 of program no.
86 Loop 1 BCD7 of program no.
87 Loop 1 BCD8 of program no.
88 Loop 2 BCD1 of program no.
89 Loop 2 BCD2 of program no.
90 Loop 2 BCD3 of program no.
91 Loop 2 BCD4 of program no.
92 Loop 2 BCD5 of program no.
93 Loop 2 BCD6 of program no.
94 Loop 2 BCD7 of program no.
95 Loop 2 BCD8 of program no.
96 BCD1 of program no. both loops
97 BCD2 of program no. both loops
98 BCD3 of program no. both loops
99 BCD4 of program no. both loops
100 BCD5 of program no. both loops
101 BCD6 of program no. both loops
102 BCD7 of program no. both loops
103 BCD8 of program no. both loops
104 Loop 1 LS. digit of gain scheduling set
105 Loop 1 2nd LS. digit of gain scheduling set
106 Loop 1 MS. digit of gain scheduling set
107 Loop 2 LS. digit of gain scheduling set
108 Loop 2 2nd LS. digit of gain scheduling set
109 Loop 2 MS. digit of gain scheduling set
110 Both loops LS. digit of gain scheduling set
111 Both loops 2nd LS. digit of gain scheduling set
112 Both loops MS. digit of gain scheduling set
113 Gravimetric adaptive fill enable loop 1
114 Gravimetric adaptive fill enable loop 2
115 Gravimetric ratio control enable both loops
116 Raise key
117 Lower key

Logic, Relay or Triac Output Functions

118 Programmer control digital output 1
119 Programmer control digital output 2
120 Programmer control digital output 3
121 Programmer control digital output 4
122 Programmer control digital output 5
123 Programmer control digital output 6
124 Programmer control digital output 7
125 Programmer control digital output 8
126 Programmer control digital output 9
127 Programmer control digital output 10
128 Programmer control digital output 11
129 Programmer control digital output 12
130 Programmer run status
131 Programmer hold status
132 Programmer reset status
133 Programmer complete status
134 Programmer holdback status
135 Programmer log hold status
136 Programmer log holdback status
137 Boolean output 1
138 Boolean output 2
139 Boolean output 3
140 Boolean output 4
141 Boolean output 5
142 Boolean output 6
143 Boolean output 7
144 Boolean output 8
145 Boolean output 9
146 Boolean output 10
147 Boolean output 11
148 Boolean output 12
149 Totaliser output 1
150 Totaliser output 2
151 Totaliser output 3
152 Totaliser output 4
153 Using default for calculated value 1
154 Using default for calculated value 2
155 Using default for calculated value 3
156 Using default for calculated value 4
157 Using default for calculated value 5
158 Using default for calculated value 6
159 Using default for calculated value 7
160 Using default for calculated value 8
161 Using default one or more calculated values
162 Loop 1 pv sensor break
163 Loop 2 pv sensor break
164 Loop 1 remote sensor break
165 Loop 2 remote sensor break
166 Loop 1 vp pot sensor break
167 Loop 2 vp pot sensor break
168 Alarm output 1
169 Alarm output 2
170 Alarm output 3
171 Alarm output 4
172 Any alarm output
173 Auto/manual status on loop 1
174 Auto/manual status on loop 2
175 Setpoint 2 status on loop 1
176 Setpoint 2 status on loop 2
177 Loop 1 shunt calibration
178 Loop 2 shunt calibration
179 Pulsed burner output one
180 Pulsed burner output two
181 Pulsed burner output three
182 Pulsed burner output four
183 Pulsed burner output five
184 Pulsed burner output six
185 Pulsed burner output seven
186 Pulsed burner output eight
187 Timer actioning 1
188 Timer actioning 2
189 Timer actioning 3
190 Timer actioning 4
191 Timer triggered 1
192 Timer triggered 2
193 Timer triggered 3
194 Timer triggered 4
195 Gravi valve loop 1
196 Gravi valve loop 2
197 Gravi empty hopper alarm loop 1
198 Gravi empty hopper alarm loop 2
199 Gravi mass flow rate available loop 1
200 Gravi mass flow rate available loop 2
201 Gravi mass flow rate valid loop 1
202 Gravi mass flow rate valid loop 2

DC Control or Re transmission Functions

203 No output function
204 Telemetry output *
205 Loop 1 channel 1 control output *
206 Loop 1 channel 2 control output *
207 Loop 2 channel 1 control output *
208 Loop 2 channel 2 control output *
209 Loop 1 setpoint
210 Loop 1 process variable
211 Loop 1 error
212 Loop 1 output
213 Loop 1 input
214 Loop 2 setpoint
215 Loop 2 process variable
216 Loop 2 error
217 Loop 2 output
218 Loop 2 input
219 Calculated value 1
220 Calculated value 2
221 Calculated value 3
222 Calculated value 4
223 Calculated value 5
224 Calculated value 6
225 Calculated value 7
226 Calculated value 8

* These functions are also available to logic outputs

DC Input Functions

227 Loop 1 remote setpoint
228 Loop 1 remote setpoint no trim
229 Loop 1 remote setpoint trim
230 Loop 1 process feedforward
231 Loop 1 remote channel 1 power limit
232 Loop 1 remote ch 1 power limit / power level
233 Loop 1 remote channel 2 power limit
234 Ratio setpoint trim function
235 Process variable 3
236 Loop 2 remote setpoint
237 Loop 2 remote setpoint no trim
238 Loop 2 remote setpoint trim
239 Loop 2 process feedforward
240 Loop 2 remote channel 1 power limit
241 Loop 2 remote ch 1 power limit / power level
242 Loop 2 remote channel 2 power limit
243 Zirconia gas correction input
244 Zirconia probe input
245 Telemetry analogue input
246 No analogue input function

Valve Positioner Functions

247 Loop 1 channel 1 VP limit
248 Loop 1 channel 2 VP limit
249 Loop 2 channel 1 VP limit
250 Loop 2 channel 2 VP limit
251 Loop 1 channel 1 VP position
252 Loop 1 channel 2 VP position
253 Loop 2 channel 1 VP position
254 Loop 2 channel 2 VP position

Control type configuration

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Control type configuration	3061	BF5h	3062	BF6h	lc
0 PID channel 1 only					
1 PID channel 1 & PID channel 2					
2 ON/OFF channel 1 only					
3 ON/OFF channel 1 & ON/OFF channel 2					
4 VP channel 1 only					
5 VP channel 1 & VP channel 2					
6 PID channel 1,VP channel 2					
7 VP channel 1, PID channel 2					
8 Pulse burner channel 1 only					
Ratio type configuration	3063	BF7h	N/A	N/A	rd
0 Ratio setpoint used as divisor					
1 Ratio setpoint used as multiplier					

Alarm configuration

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Alarm 1 type	3064	BF8h	N/A	N/A	ac
0 None					
1 Full scale high					
2 Full scale low					
3 Maximum rate of change					
4 Deviation high					
5 Deviation low					
6 Deviation band					
7 Sensor break					
Alarm 1 monitored parameter	3065	BF9h	N/A	N/A	ac
0 Process variable loop 1					
1 Process variable loop 2					
2 Output loop 1					
3 Output loop 2					
4 Linearised value loop 1					
5 Linearised value loop 2					
6 Remote linearised value loop 1					
7 Remote linearised value loop 2					
8 Valve pot position loop 1					
9 Valve pot position loop 2					
10 Alarm calculated value 1					
11 Alarm calculated value 2					
12 Alarm calculated value 3					
13 Alarm calculated value 4					
14 Alarm calculated value 5					
15 Alarm calculated value 6					
16 Alarm calculated value 7					
17 Alarm calculated value 8					
Alarm 1 hysteresis value	3066	BFAh	N/A	N/A	ac
Alarm 1 latching definition	3067	BFBh	N/A	N/A	ac
0 Non latching					
1 Latching					
Alarm 1 delay configuration	3068	BFCh	N/A	N/A	ac
0 No alarm delay					
1 Alarm delay					
Alarm 2 type (as 6064)	3069	BFDh	N/A	N/A	ac
Alarm 2 monitored parameter (as 6065)	3070	BFEh	N/A	N/A	ac
Alarm 2 hysteresis value	3071	BFFh	N/A	N/A	ac
Alarm 2 latching definition (as 6067)	3072	C00h	N/A	N/A	ac
Alarm 2 delay configuration (as 6068)	3073	C01h	N/A	N/A	ac
Alarm 3 type (as 6064)	3074	C02h	N/A	N/A	ac
Alarm 3 monitored parameter (as 6065)	3075	C03h	N/A	N/A	ac
Alarm 3 hysteresis value	3076	C04h	N/A	N/A	ac
Alarm 3 latching definition (as 6067)	3077	C05h	N/A	N/A	ac
Alarm 3 delay configuration (as 6068)	3078	C06h	N/A	N/A	ac
Alarm 4 type (as 6064)	3079	C07h	N/A	N/A	ac

Alarm configuration - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Alarm 4 monitored parameter (as 6065)	3080	C08h	N/A	N/A	ac
Alarm 4 hysteresis value	3081	C09h	N/A	N/A	ac
Alarm 4 latching definition (as 6067)	3082	C0Ah	N/A	N/A	ac
Alarm 4 delay configuration (as 6068)	3083	C0Bh	N/A	N/A	ac

Control configuration

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Control action 0 Reverse acting control 1 Direct acting control	3084	C0Ch	3087	C0Fh	cc
Derivative action 0 Error 1 Process variable	3085	C0Dh	3088	C10h	cc
Power feedback 0 No power feedback 1 Power feedback configured	3086	C0Eh	3089	C11h	cc
Manual tracking definition 0 No manual tracking 1 Manual tracking	3090	C12h	3091	C13h	st
Remote tracking definition 0 No remote tracking 1 Remote tracking	3092	C14h	3093	C15h	st
Ratio tracking definition 0 No ratio tracking 1 Ratio tracking	3094	C16h	N/A	N/A	st
Cascade tracking definition 0 No cascade tracking 1 Cascade tracking	3095	C17h	N/A	N/A	st
Standby mode availability 0 Not available 1 Available	3096	C18h	N/A	N/A	fc
Scheduler availability 0 No scheduler available 1 Daily scheduler	3097	C19h	N/A	N/A	fc
Setpoint rate limit availability (as 3096)	3098	C1Ah	3104	C20h	fc
Manual function availability 0 No manual function 1 Manual from keys and inputs 2 Manual from digital inputs only 3 Forced output from keys and inputs 4 Forced output from inputs only	3099	C1Bh	3105	C21h	fc
Output rate limit availability (as 3096)	3101	C1Dh	3107	C23h	fc
Setpoint feedforward availability 0 Not available 1 SP feedforward 2 PV feedforward	3102	C1Eh	3108	C24h	fc
Feedforward availability (as 3096)	3103	C1Fh	3109	C25h	fc
Autotune availability (as 3096)	3110	C26h	3113	C29h	tc
Adaptive tuning availability (as 3096)	3111	C27h	3114	C2Ah	tc

Control configuration - continued

Parameter Description		Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
		dec	hex	dec	hex	
Adaptive tuning type		3112	C28h	3115	C2Bh	tc
0	Continuous adaptive tuning					
1	Working setpoint scheduling					
2	Process value scheduling					
3	Output actual level scheduling					
4	Remote loop 1 scheduling					
5	Remote loop 2 scheduling					
6	Error scheduling					
7	Gain scheduling set select by logic input (See logic input functions 104 to 112)					

Digital communications configuration

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Comms configuration	3116	C2Ch	N/A	N/A	dc
0 No digital comms type					
1 EI slave					
2 JBUS slave					
3 MODBUS slave					
(See 3385/6 for JBUS resol & parity)					

Output configuration

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Slot 1 normal or inverted output 0 Normal 1 Inverted	3117	C2Dh	N/A	N/A	oc
Slot 2 normal or inverted output (as 3117)	3118	C2Eh	N/A	N/A	oc
Slot 3 normal or inverted output (as 3117)	3119	C2Fh	N/A	N/A	oc
Slot 4 normal or inverted output (as 3117)	3120	C30h	N/A	N/A	oc
Slot 5 normal or inverted output (as 3117)	3121	C31h	N/A	N/A	oc
Slot 6 normal or inverted output (as 3117)	3122	C32h	N/A	N/A	oc
Cooling type definition 0 Linear cooling 1 Fan 2 Water 3 Oil	3123	C33h	3124	C34h	oc
Slot 1 output current/voltage 0 Volts 1 milliAmps	3125	C35h	N/A	N/A	oc
Slot 1 output high limit	3126	C36h	N/A	N/A	oc
Slot 1 output low limit	3127	C37h	N/A	N/A	oc
Slot 1 output range minimum	3128	C38h	N/A	N/A	oc
Slot 1 output range maximum	3129	C39h	N/A	N/A	oc
Slot 2 output current/voltage (as 3125)	3130	C3Ah	N/A	N/A	oc
Slot 2 output high limit	3131	C3Bh	N/A	N/A	oc
Slot 2 output low limit	3132	C3Ch	N/A	N/A	oc
Slot 2 output range minimum	3133	C3Dh	N/A	N/A	oc
Slot 2 output range maximum	3134	C3Eh	N/A	N/A	oc
Slot 3 output current/voltage (as 3125)	3135	C3Fh	N/A	N/A	oc
Slot 3 output high limit	3136	C40h	N/A	N/A	oc
Slot 3 output low limit	3137	C41h	N/A	N/A	oc
Slot 3 output range minimum	3138	C42h	N/A	N/A	oc
Slot 3 output range maximum	3139	C43h	N/A	N/A	oc
Slot 4 output current/voltage (as 3125)	3140	C44h	N/A	N/A	oc
Slot 4 output high limit	3141	C45h	N/A	N/A	oc
Slot 4 output low limit	3142	C46h	N/A	N/A	oc
Slot 4 output range minimum	3143	C47h	N/A	N/A	oc
Slot 4 output range maximum	3144	C48h	N/A	N/A	oc
Slot 5 output current/voltage (as 3125)	3145	C49h	N/A	N/A	oc
Slot 5 output high limit	3146	C4Ah	N/A	N/A	oc
Slot 5 output low limit	3147	C4Bh	N/A	N/A	oc
Slot 5 output range minimum	3148	C4Ch	N/A	N/A	oc
Slot 5 output range maximum	3149	C4Dh	N/A	N/A	oc
Slot 6 output current/voltage (as 3125)	3150	C4Eh	N/A	N/A	oc
Slot 6 output high limit	3151	C4Fh	N/A	N/A	oc
Slot 6 output low limit	3152	C50h	N/A	N/A	oc
Slot 6 output range minimum	3153	C51h	N/A	N/A	oc
Slot 6 output range maximum	3154	C52h	N/A	N/A	oc

Input general configuration

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Process input filter definition 0 No filtering 1 Single pole exponantion filter (See 3244 for time constant)	3155	C53h	3156	C54h	ip
Remote input filter definition 0 No filter 1 Single pole exponantial (See 3245 for time constant)	3157	C55h	3158	C56h	ip
CJC type 0 No CJC 1 Internal CJC 2 External CJC	3159	C57h	3161	C59h	ip
CJC value	3160	C58h	3162	C5Ah	ip
Normal/inverse process input 1 0 Normal 1 Inverted	3163	C5Bh	N/A	N/A	ip
Normal/inverse process input 2 (as 3163)	3164	C5Ch	N/A	N/A	ip
Input sampling 10/20 Hz 0 20 Hz 1 10 Hz	3165	C5Dh	N/A	N/A	ip
Fraction of process input 1	3166	C5Eh	3168	C60h	F1
Fraction of process input 2	3167	C5Fh	3169	C61h	F2
Derived input high limit	3170	C62h	3172	C64h	Dh
Derived input low limit	3171	C63h	3173	C65h	dl
Transducer scaling type 1 Gain only transducer scaling 2 Gain offset transducer scaling 3 Shunt cal transducer scaling	3174	C66h	3175	C67h	ts

Custom linearisation, sensor break and filter configuration

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Custom linearisation input value 1	3176	C68h	3208	C88h	LV
Custom linearisation input value 2	3177	C69h	3209	C89h	LV
Custom linearisation input value 3	3178	C6Ah	3210	C8Ah	LV
Custom linearisation input value 4	3179	C6Bh	3211	C8Bh	LV
Custom linearisation input value 5	3180	C6Ch	3212	C8Ch	LV
Custom linearisation input value 6	3181	C6Dh	3213	C8Dh	LV
Custom linearisation input value 7	3182	C6Eh	3214	C8Eh	LV
Custom linearisation input value 8	3183	C6Fh	3215	C8Fh	LV
Custom linearisation input value 9	3184	C70h	3216	C90h	LV
Custom linearisation input value 10	3185	C71h	3217	C91h	LV
Custom linearisation input value 11	3186	C72h	3218	C92h	LV
Custom linearisation input value 12	3187	C73h	3219	C93h	LV
Custom linearisation input value 13	3188	C74h	3220	C94h	LV
Custom linearisation input value 14	3189	C75h	3221	C95h	LV
Custom linearisation input value 15	3190	C76h	3222	C96h	LV
Custom linearisation input value 16	3191	C77h	3223	C97h	LV
Custom linearisation display value 1	3192	C78h	3224	C98h	LD
Custom linearisation display value 2	3193	C79h	3225	C99h	LD
Custom linearisation display value 3	3194	C7Ah	3226	C9Ah	LD
Custom linearisation display value 4	3195	C7Bh	3227	C9Bh	LD
Custom linearisation display value 5	3196	C7Ch	3228	C9Ch	LD
Custom linearisation display value 6	3197	C7Dh	3229	C9Dh	LD
Custom linearisation display value 7	3198	C7Eh	3230	C9Eh	LD
Custom linearisation display value 8	3199	C7Fh	3231	C9Fh	LD
Custom linearisation display value 9	3200	C80h	3232	CA0h	LD
Custom linearisation display value 10	3201	C81h	3233	CA1h	LD
Custom linearisation display value 11	3202	C82h	3234	CA2h	LD
Custom linearisation display value 12	3203	C83h	3235	CA3h	LD
Custom linearisation display value 13	3204	C84h	3236	CA4h	LD
Custom linearisation display value 14	3205	C85h	3237	CA5h	LD
Custom linearisation display value 15	3206	C86h	3238	CA6h	LD
Custom linearisation display value 16	3207	C87h	3239	CA7h	LD
Process input sensor break position	3240	CA8h	3241	CA9h	PP
Remote input sensor break position	3242	CAAh	3243	CABh	RP
Process input filter time constant	3244	CACh	3245	CADh	IF
Remote input filter time constant	3246	CAEh	3247	CAFh	RF

Programmer configuration

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Holdback definition 0 Holdback unavailable 1 Holdback available	3248	CB0h	N/A	N/A	pc
Subprogram definition 0 No sub programme available 1 Subprogramme available	3249	CB1h	N/A	N/A	pc
Programmer digital output definition 0 Program digital output unavailable 1 Program digital output available	3250	CB2h	N/A	N/A	pc
Fast run definition 0 No fast run 1 Fast run in standby 2 Always fast run	3251	CB3h	N/A	N/A	pc

Units configuration

The units of the instrument are defined with the parameter, 'process input units'. The list below shows the number used to select each unit.

Parameter Description				Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
				dec	hex	dec	hex	
Process input units				3252	CB4h	3253	CB5h	iu
0	None	40	OHMS					
1	deg celcius	41	KG/CM3					
2	deg fahrenheit	42	KG					
3	deg kelvin	43	psig					
4	volts	44	inH2O					
5	amps	45	kN					
6	milliamps	46	Eh					
7	millivolts	47	%O2					
8	acidity	48	ppm					
9	% acidity	49	cSt					
10	mmHg	50	pH/10					
11	p.s.i.	51	sg					
12	p.s.i. 10	52	kgcm					
13	bar	53	l/s					
14	mbar	54	feet					
15	mWG	55	MW					
16	gal/min	56	%/h					
17	rev/min	57	%CO2					
18	l/min	58	SecRW					
19	l/h	59	kN/m2					
20	l*10	60	m3/h					
21	cm/s	61	BPH					
22	m/s	62	N					
23	mile/h	63	volts					
24	mPas	64	amps					
25	kPa	65	litres					
26	kg/cm2	66	tonne					
27	T/h	67	mph					
28	Relative humidity	68	Hz					
29	*10	69	kHz					
30	percent	70	g					
31	rpm	71	mg					
32	*5	72	Carbon potential					
33	K/H	73	Oxygen percent					
34	deg L	74	Oxygen vpm					
35	kVA	75	Oxygen log					
36	MMWG	76	Dew point deg celcius					
37	INWG	77	Custom unit					
38	INWW							
39	WG							

Units configuration - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Proportional band units	3254	CB6h	N/A	N/A	iu
0 Percentage of instrument span					
1 Engineering units					
Derivative/integral time units	3255	CB7h	N/A	N/A	iu
0 Seconds					
1 Minutes					
Setpoint rate limit units	3256	CB8h	N/A	N/A	iu
4 per minute					
5 per hour					
Output rate limit units (as 3256)	3257	CB9h	N/A	N/A	iu
Warm up screen configuration	3258	CBAh	N/A	N/A	wt
0 Eurotherm					
1 Custom					
Display test	3259	CBBh	N/A	N/A	dt
0 No test					
1 Vertical odd					
2 Vertical even					
3 Horizontal odd					
4 Horizontal even					
5 Checker board odd					
6 Checker board even					
Mains frequency	3260	CBCh	N/A	N/A	md
0 50 Hz					
1 60 Hz					
Number of pulsed burners	3261	CBDh	N/A	N/A	nb
Number of process inputs	3262	CBEh	N/A	N/A	np
Configuration mode telemetry enable	3263	CBFh	N/A	N/A	et
0 Telemetry mode disabled					
1 Enable telemetry mode					
I/O slot number	3264	CC0h	N/A	N/A	mn
1 Slot 1					
2 Slot 2					
3 Slot 3					
4 Slot 4					
5 Slot 5					
6 Slot 6					

Totaliser and calculated value configuration

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Totaliser 1 input parameter	3265	CC1h	N/A	N/A	t1
1 Input process variable 1					
2 Input process variable 2					
3 Input linearised value 1					
4 Input linearised value 2					
5 Input remote value 1					
6 Input remote value 2					
7 Input output 1					
8 Input output 2					
9 Input working setpoint 1					
10 Input working setpoint 2					
11 Input programmer setpoint 1					
12 Input programmer setpoint 2					
13 Input vp pot position 1					
14 Input vp pot position 2					
15 Input error 1					
16 Input error 2					
17 Input calculated value 1					
18 Input calculated value 2					
19 Input calculated value 3					
20 Input calculated value 4					
21 Input calculated value 5					
22 Input calculated value 6					
23 Input calculated value 7					
24 Input calculated value 8					
25 Input user constant 1					
26 Input user constant 2					
27 Input user constant 3					
28 Input user constant 4					
29 Input totaliser 1					
30 Input totaliser 2					
31 Input totaliser 3					
32 Input totaliser 4					
33 Input Ch 1 power limit 1					
34 Input Ch 1 power limit 2					
35 Input Ch 1 low power limit 1					
36 Input Ch 1 low power limit 2					
37 Input Ch 2 power limit 1					
38 Input Ch 2 power limit 2					
Totaliser 2 input parameter (as 3265)	3266	CC2h	N/A	N/A	t2
Totaliser 3 input parameter (as 3265)	3267	CC3h	N/A	N/A	t3
Totaliser 4 input parameter (as 3265)	3268	CC4h	N/A	N/A	t4

Totaliser and calculated value configuration - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Zirconia probe function	3269	CC5h	N/A	N/A	op
0 Dew point					
1 Oxygen					
2 Carbon Drayton					
3 Carbon Accucarb					
Number of programs	3270	CC6h	N/A	N/A	pc
0 20 programmes					
1 50 programmes					
Remote input resolution configuration	3271	CC7h	3272	CC8h	rr
0 0 decimal places					
1 1 decimal places					
2 2 decimal places					
3 3 decimal places					
User value 1 high limit	3273	CC9h	N/A	N/A	c1
User value 2 high limit	3274	CCAh	N/A	N/A	c2
User value 3 high limit	3275	CCBh	N/A	N/A	c3
User value 4 high limit	3276	CCCh	N/A	N/A	c4
User value 1 low limit	3277	CCDh	N/A	N/A	c1
User value 2 low limit	3278	CCEh	N/A	N/A	c2
User value 3 low limit	3279	CCFh	N/A	N/A	c3
User value 4 low limit	3280	CD0h	N/A	N/A	c4
User value 1 resolution (as 3271)	3281	CD1h	N/A	N/A	c1
User value 2 resolution (as 3271)	3282	CD2h	N/A	N/A	c2
User value 3 resolution (as 3271)	3283	CD3h	N/A	N/A	c3
User value 4 resolution (as 3271)	3284	CD4h	N/A	N/A	c4
Calculated value 1 1st input (as 3265)	3285	CD5h	N/A	N/A	w1
Calculated value 1 1st input scaler	3286	CD6h	N/A	N/A	w1
Calculated value 1 operator	3287	CD7h	N/A	N/A	w1
1 Add					
2 Subtract					
3 Multiply					
4 Divide					
5 Absolute difference					
6 Select max					
7 Select min					
8 Switchover					
9 Select on boolean 1					
10 Select on boolean 2					
11 Select on boolean 3					
12 Select on boolean 4					
Calculated value 1 2nd input (as 3265)	3288	CD8h	N/A	N/A	w1
Calculated value 1 2nd input scaler	3289	CD9h	N/A	N/A	w1

Totaliser and calculated value configuration - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Calculated value 1 O/P	3290	CDAh	N/A	N/A	w1
1 O/P process variable loop 1					
2 O/P process variable loop 2					
3 O/P remote setpoint loop 1					
4 O/P remote setpoint loop 2					
5 O/P working setpoint loop 1					
6 O/P working setpoint loop 2					
7 O/P remote power limit loop 1					
8 O/P remote power limit loop 2					
9 O/P remote power limit/level loop 1					
10 O/P remote power limit/level loop 2					
11 O/P remote low power limit loop 1					
12 O/P remote low power limit loop 2					
13 O/P feedforward value loop 1					
14 O/P feedforward value loop 2					
15 O/P proportional band loop 1					
16 O/P proportional band loop 2					
17 O/P integral time loop 1					
18 O/P integral time loop 2					
19 O/P power loop 1					
20 O/P power loop 2					
21 O/P setpoint 1 loop 1					
22 O/P setpoint 1 loop 2					
Calculated value 1 upper limit	3291	CDBh	N/A	N/A	w1
Calculated value 1 lower limit	3292	CDCh	N/A	N/A	w1
Calculated value 1 resolution (as 3271)	3293	CDDh	N/A	N/A	w1
Calculated value 1 default value	3294	CDEh	N/A	N/A	w1
Calculated value 2 1st input (as 3265)	3295	CDFh	N/A	N/A	w2
Calculated value 2 1st input scaler	3296	CE0h	N/A	N/A	w2
Calculated value 2 operator (as 3287)	3297	CE1h	N/A	N/A	w2
Calculated value 2 2nd input (as 3265)	3298	CE2h	N/A	N/A	w2
Calculated value 2 2nd input scaler	3299	CE3h	N/A	N/A	w2
Calculated value 2 output (as 3290)	3300	CE4h	N/A	N/A	w2
Calculated value 2 upper limit	3301	CE5h	N/A	N/A	w2
Calculated value 2 lower limit	3302	CE6h	N/A	N/A	w2
Calculated value 2 resolution (as 3271)	3303	CE7h	N/A	N/A	w2
Calculated value 2 default value	3304	CE8h	N/A	N/A	w2
Calculated value 3 1st input (as 3265)	3305	CE9h	N/A	N/A	w3
Calculated value 3 1st input scaler	3306	CEAh	N/A	N/A	w3
Calculated value 3 operator (as 3287)	3307	CEBh	N/A	N/A	w3
Calculated value 3 2nd input (as 3265)	3308	CECh	N/A	N/A	w3
Calculated value 3 2nd input scaler	3309	CEDh	N/A	N/A	w3
Calculated value 3 output (as 3290)	3310	CEEh	N/A	N/A	w3
Calculated value 3 upper limit	3311	CEFh	N/A	N/A	w3
Calculated value 3 lower limit	3312	CF0h	N/A	N/A	w3
Calculated value 3 resolution (as 3271)	3313	CF1h	N/A	N/A	w3

Totaliser and calculated value configuration - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Calculated value 3 default value	3314	CF2h	N/A	N/A	w3
Calculated value 4 1st input (as 3265)	3315	CF3h	N/A	N/A	w4
Calculated value 4 1st input scaler	3316	CF4h	N/A	N/A	w4
Calculated value 4 operator (as 3287)	3317	CF5h	N/A	N/A	w4
Calculated value 4 2nd input (as 3265)	3318	CF6h	N/A	N/A	w4
Calculated value 4 2nd input scaler	3319	CF7h	N/A	N/A	w4
Calculated value 4 output (as 3290)	3320	CF8h	N/A	N/A	w4
Calculated value 4 upper limit	3321	CF9h	N/A	N/A	w4
Calculated value 4 lower limit	3322	CFAh	N/A	N/A	w4
Calculated value 4 resolution (as 3271)	3323	CFBh	N/A	N/A	w4
Calculated value 4 default value	3324	CFCh	N/A	N/A	w4
Calculated value 5 1st input (as 3265)	3325	CFDh	N/A	N/A	w5
Calculated value 5 1st input scaler	3326	CFEh	N/A	N/A	w5
Calculated value 5 operator (as 3287)	3327	CFFh	N/A	N/A	w5
Calculated value 5 2nd input (as 3265)	3328	D00h	N/A	N/A	w5
Calculated value 5 2nd input scaler	3329	D01h	N/A	N/A	w5
Calculated value 5 output (as 3290)	3330	D02h	N/A	N/A	w5
Calculated value 5 upper limit	3331	D03h	N/A	N/A	w5
Calculated value 5 lower limit	3332	D04h	N/A	N/A	w5
Calculated value 5 resolution (as 3271)	3333	D05h	N/A	N/A	w5
Calculated value 5 default value	3334	D06h	N/A	N/A	w5
Calculated value 6 1st input (as 3265)	3335	D07h	N/A	N/A	w6
Calculated value 6 1st input scaler	3336	D08h	N/A	N/A	w6
Calculated value 6 operator (as 3287)	3337	D09h	N/A	N/A	w6
Calculated value 6 2nd input (as 3265)	3338	D0Ah	N/A	N/A	w6
Calculated value 6 2nd input scaler	3339	D0Bh	N/A	N/A	w6
Calculated value 6 output (as 3290)	3340	D0Ch	N/A	N/A	w6
Calculated value 6 upper limit	3341	D0Dh	N/A	N/A	w6
Calculated value 6 lower limit	3342	D0Eh	N/A	N/A	w6
Calculated value 6 resolution (as 3271)	3343	D0Fh	N/A	N/A	w6
Calculated value 6 default value	3344	D10h	N/A	N/A	w6
Calculated value 7 1st input (as 3265)	3345	D11h	N/A	N/A	w7
Calculated value 7 1st input scaler	3346	D12h	N/A	N/A	w7
Calculated value 7 operator (as 3287)	3347	D13h	N/A	N/A	w7
Calculated value 7 2nd input (as 3265)	3348	D14h	N/A	N/A	w7
Calculated value 7 2nd input scaler	3349	D15h	N/A	N/A	w7
Calculated value 7 output (as 3290)	3350	D16h	N/A	N/A	w7
Calculated value 7 upper limit	3351	D17h	N/A	N/A	w7
Calculated value 7 lower limit	3352	D18h	N/A	N/A	w7
Calculated value 7 resolution (as 3271)	3353	D19h	N/A	N/A	w7
Calculated value 7 default value	3354	D1Ah	N/A	N/A	w7
Calculated value 8 1st input (as 3265)	3355	D1Bh	N/A	N/A	w8
Calculated value 8 1st input scaler	3356	D1Ch	N/A	N/A	w8
Calculated value 8 operator (as 3287)	3357	D1Dh	N/A	N/A	w8
Calculated value 8 2nd input (as 3265)	3358	D1Eh	N/A	N/A	w8
Calculated value 8 2nd input scaler	3359	D1Fh	N/A	N/A	w8

Totaliser and calculated value configuration - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Calculated value 8 output (as 3290)	3360	D20h	N/A	N/A	w8
Calculated value 8 upper limit	3361	D21h	N/A	N/A	w8
Calculated value 8 lower limit	3362	D22h	N/A	N/A	w8
Calculated value 8 resolution (as 3271)	3363	D23h	N/A	N/A	w8
Calculated value 8 default value	3364	D24h	N/A	N/A	w8
PV high limit for zirconia input	3365	D25h	N/A	N/A	zh
PV low limit for zirconia input	3366	D26h	N/A	N/A	zl
PV resolution for zirconia input	3367	D27h	N/A	N/A	zr
Zirconia probe oxygen function 0 Percent oxygen 1 vpm oxygen 2 Log oxygen	3368	D28h	N/A	N/A	os
RT bulb resistor configuration 0 13kohm 1 27kohm	3369	D29h	3370	D2Ah	rt

Timer configuration

The 900 EPC provides four timer functions. The input and output functions of these timers are defined by the numbers in the function lists below.

The JBUS addresses relating to the timers are in the table below;

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Timer 1 type 0 No timer function 1 Timed event 2 On off delay	3371	D2Bh	N/A	N/A	td
Timer 1 input parameter (see below)	3372	D2Ch	N/A	N/A	td
Timer 1 output function (see below)	3373	D2Dh	N/A	N/A	td
Timer 2 type (as 3371)	3374	D2Eh	N/A	N/A	td
Timer 2 input parameter (see below)	3375	D2Fh	N/A	N/A	td
Timer 2 output function (see below)	3376	D30h	N/A	N/A	td
Timer 3 type (as 3371)	3377	D31h	N/A	N/A	td
Timer 3 input parameter (see below)	3378	D32h	N/A	N/A	td
Timer 3 output function (see below)	3379	D33h	N/A	N/A	td
Timer 4 type (as 3371)	3380	D34h	N/A	N/A	td
Timer 4 input parameter (see below)	3381	D35h	N/A	N/A	td
Timer 4 output function (see below)	3382	D36h	N/A	N/A	td

Timer Input Parameter Values (JBUS addresses 3372, 3375, 3378, 3381)

1	Programmer digital output 1
2	Programmer digital output 2
3	Programmer digital output 3
4	Programmer digital output 4
5	Programmer digital output 5
6	Programmer digital output 6
7	Programmer digital output 7
8	Programmer digital output 8
9	Programmer digital output 9
10	Programmer digital output 10
11	Programmer digital output 11
12	Programmer digital output 12
13	Programmer run status
14	Programmer hold status
15	Programmer reset status
16	Programmer complete status
17	Programmer holdback status
18	Programmer log hold status
19	Programmer log holdback status
20	Boolean 1
21	Boolean 2
22	Boolean 3
23	Boolean 4
24	Boolean 5
25	Boolean 6
26	Boolean 7
27	Boolean 8
28	Boolean 9
29	Boolean 10
30	Boolean 11
31	Boolean 12
32	Boolean constant 1
33	Boolean constant 2
34	Boolean constant 3
35	Boolean constant 4
36	Totaliser output 1
37	Totaliser output 2
38	Totaliser output 3
39	Totaliser output 4
40	Any totaliser output
41	Default calculated value 1
42	Default calculated value 2
43	Default calculated value 3
44	Default calculated value 4
45	Default calculated value 5
46	Default calculated value 6
47	Default calculated value 7
48	Default calculated value 8
49	Default any calculated values
50	Loop 1 pv sensor break
51	Loop 2 pv sensor break
52	Loop 1 remote sensor break
53	Loop 2 remote sensor break
54	Loop 1 vp pot sensor break
55	Loop 2 vp pot sensor break
56	Alarm output 1
57	Alarm output 2
58	Alarm output 3
59	Alarm output 4
60	Any alarm output
61	Auto/manual status on loop 1
62	Auto/manual status on loop 2
63	Remote status loop 1
64	Remote status loop 2

Timer Input Parameter Values (JBUS addresses 3372, 3375, 3378, 3381) continued

65 Setpoint rate limit status loop 1
66 Setpoint rate limit status loop 2
67 Output rate limit status loop 1
68 Output rate limit status loop 2
69 Setpoint 2 status on loop 1
70 Setpoint 2 status on loop 2
71 Autotune status loop 1
72 Autotune status loop 2
73 Adaptive tune status loop 1
74 Adaptive tune status loop 2
75 Gain scheduling status loop 1
76 Gain scheduling status loop 2
77 Standby status
78 Timer status
79 Ratio status
80 Ratio setpoint 2 status
81 Cascade status
82 Digital input 1
83 Digital input 2
84 Digital input 3
85 Digital input 4
86 Digital input 5
87 Digital input 6
88 Digital input 7
89 Digital input 8
90 Digital input 9
91 Digital input 10
92 Digital input 11
93 Digital input 12
94 Digital input 13
95 Digital input 14
96 Digital input 15
97 Digital input 16
98 Digital input 17
99 Digital input 18
100 Digital input 19
101 Digital input 20
102 Digital input 21
103 Digital input 22
104 Digital input 23
105 Digital input 24
106 Digital input 25
107 Digital input 26
108 Timer 1 actioning
109 Timer 2 actioning
110 Timer 3 actioning
111 Timer 4 actioning
112 Timer 1 triggered
113 Timer 2 triggered
114 Timer 3 triggered
115 Timer 4 triggered
116 Gravi adaptive fill enable loop 1
117 Gravi adaptive fill enable loop 2
118 Gravi ratio control enable both loops
119 Gravi valve loop 1
120 Gravi valve loop 2
121 Gravi empty hopper alarm loop 1
122 Gravi empty hopper alarm loop 2
123 Gravi mass flow rate available loop 1
124 Gravi mass flow rate available loop 2
125 Gravi mass flow rate valid loop 1
126 Gravi mass flow rate valid loop 2

Timer Output Function Values (JBUS addresses 3373, 3376, 3379, 3382)

0 No digital input function
1 Auto/Manual loop 1
2 Remote enable loop 1
3 Setpoint 2 enable loop 1
4 Setpoint rate limit enable loop 1
5 Freeze integral action on loop 1
6 Output rate limit enable loop 1
7 Autotune enable loop 1
8 Adaptive tune enable loop 1
9 Gain scheduling enable loop 1
10 Ratio enable O/P
11 Ratio setpoint 2 enable
12 Cascade enable
13 Auto/Manual loop 2
14 Remote enable loop 2
15 Setpoint 2 enable loop 2
16 Setpoint rate limit enable loop 2
17 Freeze integral action on loop 2
18 Output rate limit enable loop 2
19 Autotune enable loop 2
20 Adaptive tune enable loop 2
21 Gain scheduling enable loop 2
22 Auto/Manual both loops
23 Remote enable both loops
24 Setpoint 2 both loops
25 Setpoint rate limit enable both loops
26 Freeze integral both loops
27 Output rate limit both loops
28 Autotune enable both loops
29 Adaptive tune enable both loops
30 Gain scheduling enable both loops
31 Keylock enable
32 Use input 2
33 Digital comms disable
34 Digital retransmission disable
35 Broadcast disable
36 Standby mode enable
37 Timer disable
38 Timer 1 enable
39 Timer 2 enable
40 Timer 3 enable
41 Timer 4 enable
42 Setpoint 1 loop 1
43 Setpoint 1 loop 2
44 Setpoint 1 both loops
45 Alarm acknowledge
46 Telemetry digital input
47 Reset totaliser 1
48 Reset totaliser 2
49 Reset totaliser 3
50 Reset totaliser 4
51 Reset all totalisers
52 Run O/P
53 Reset
54 Hold
55 Run/Hold
56 Run/Reset

57 Hold/Run
58 Holdback disable
59 Loop 1 skip current segment
60 Loop 2 skip current segment
61 Skip current segment both loops
62 Loop 1 wait until
63 Loop 2 wait until
64 Both loops wait until
65 Load program loop 1
66 Load program loop 2
67 Load program both loops
68 Loop 1 l.s. digit of program no.
69 Loop 1 2nd l.s. digit of program no.
70 Loop 1 3rd l.s. digit of program no.
71 Loop 1 m.s. digit of program no.
72 Loop 2 l.s. digit of program no.
73 Loop 2 2nd l.s. digit of program no.
74 Loop 2 3rd l.s. digit of program no.
75 Loop 2 m.s. digit of program no.
76 L.s. digit of program no. both loops
77 2nd l.s. digit of program no. both loops
78 3rd l.s. digit of program no. both loops
79 KM:s. digit of program no. both loops
80 Loop 1 BCD1 of program no.
81 Loop 1 BCD2 of program no.
82 Loop 1 BCD3 of program no.
83 Loop 1 BCD4 of program no.
84 Loop 1 BCD5 of program no.
85 Loop 1 BCD6 of program no.
86 Loop 1 BCD7 of program no.
87 Loop 1 BCD8 of program no.
88 Loop 2 BCD1 of program no.
89 Loop 2 BCD2 of program no.
90 Loop 2 BCD3 of program no.
91 Loop 2 BCD4 of program no.
92 Loop 2 BCD5 of program no.
93 Loop 2 BCD6 of program no.
94 Loop 2 BCD7 of program no.
95 Loop 2 BCD8 of program no.
96 BCD1 of program no. both loops
97 BCD2 of program no. both loops
98 BCD3 of program no. both loops
99 BCD4 of program no. both loops
100 BCD5 of program no. both loops
101 BCD6 of program no. both loops
102 BCD7 of program no. both loops
103 BCD8 of program no. both loops
104 Loop 1 l.s. digit of gain scheduling set
105 Loop 1 2nd l.s. digit of gain scheduling set
106 Loop 1 m.s. digit of gain scheduling set
107 Loop 2 l.s. digit of gain scheduling set
108 Loop 2 2nd l.s. digit of gain scheduling set
109 Loop 2 m.s. digit of gain scheduling set
110 Both loops l.s. digit of gain scheduling set
111 Both loops 2nd l.s. digit of gain scheduling set
112 Both loops m.s. digit of gain scheduling set
113 Gravimetric ratio control enable
114 Adaptive fill enable
115 Raise key
116 Lower key
117 Programmer control digital output 1
118 Programmer control digital output 2
119 Programmer control digital output 3
120 Programmer control digital output 4
121 Programmer control digital output 5
122 Programmer control digital output 6
123 Programmer control digital output 7
124 Programmer control digital output 8
125 Programmer control digital output 9
126 Programmer control digital output 10
127 Programmer control digital output 11
128 Programmer control digital output 12
129 Programmer run status
130 Programmer hold status
131 Programmer reset status
132 Programmer complete status
133 Programmer holdback status
134 Programmer log hold status
135 Programmer log holdback status
136 Boolean output 1
137 Boolean output 2
138 Boolean output 3
139 Boolean output 4
140 Boolean output 5
141 Boolean output 6
142 Boolean output 7
143 Boolean output 8
144 Boolean output 9
145 Boolean output 10
146 Boolean output 11
147 Boolean output 12
148 Totaliser output 1
149 Totaliser output 2
150 Totaliser output 3
151 Totaliser output 4
152 Using default for calculated value 1
153 Using default for calculated value 2
154 Using default for calculated value 3
155 Using default for calculated value 4
156 Using default for calculated value 5
157 Using default for calculated value 6
158 Using default for calculated value 7
159 Using default for calculated value 8
160 Using default one or more calculated values
161 Loop 1 pv sensor break
162 Loop 2 pv sensor break
163 Loop 1 remote sensor break
164 Loop 2 remote sensor break
165 Loop 1 vp pot sensor break
166 Loop 2 vp pot sensor break
167 Alarm output 1
168 Alarm output 2
169 Alarm output 3
170 Alarm output 4
171 Any alarm output
172 Auto/manual status on loop 1
173 Auto/manual status on loop 2
174 Setpoint 2 status on loop 1
175 Setpoint 2 status on loop 2
176 Loop 1 shunt cal
177 Loop 2 shunt cal
178 Pulsed burner output one
179 Pulsed burner output two
180 Pulsed burner output three
181 Pulsed burner output four
182 Pulsed burner output five

Timer Output Function Values (JBUS addresses 3373, 3376, 3379, 3382) continued

183 Pulsed burner output six
184 Pulsed burner output seven
185 Pulsed burner output eight
186 Timer actioning 1
187 Timer actioning 2
188 Timer actioning 3
189 Timer actioning 4
190 Timer triggered 1
191 Timer triggered 2
192 Timer triggered 3
193 Timer triggered 4
194 Gravi valve loop 1
195 Gravi valve loop 2
196 Gravi empty hopper alarm loop 1
197 Gravi empty hopper alarm loop 2
198 No output function
199 Telemetry output
200 Loop 1 channel 1 control output
201 Loop 1 channel 2 control output
202 Loop 2 channel 1 control output
203 Loop 2 channel 2 control output
204 Loop 1 setpoint
205 Loop 1 process variable
206 Loop 1 error
207 Loop 1 output
208 Loop 1 input
209 Loop 2 setpoint
210 Loop 2 process variable
211 Loop 2 error
212 Loop 2 output
213 Loop 2 input
214 Calculated value 1
215 Calculated value 2
216 Calculated value 3
217 Calculated value 4
218 Calculated value 5
219 Calculated value 6
220 Calculated value 7
221 Calculated value 8
222 Loop 1 remote setpoint
223 Loop 1 remote setpoint no trim
224 Loop 1 remote setpoint trim
225 Loop 1 process feedforward
226 Loop 1 remote channel 1 power Limit
227 Loop 1 remote ch 1 power Limit / power Level
228 Loop 1 remote channel 2 power Limit
229 Ratio setpoint trim function
230 Process variable 3
231 Loop 2 remote setpoint
232 Loop 2 remote setpoint no trim
233 Loop 2 remote setpoint trim
234 Loop 2 process feedforward
235 Loop 2 remote channel 1 power Limit
236 Loop 2 remote ch 1 power Limit / power Level
237 Loop 2 remote channel 2 power Limit
238 Zirconia gas correction input
239 Zirconia probe input
240 Telemetry analogue input
241 No analogue input function
242 Loop 1 channel 1 VP limit
243 Loop 1 channel 2 VP limit
244 Loop 2 channel 1 VP limit
245 Loop 2 channel 2 VP limit
246 Loop 1 channel 1 VP position
247 Loop 1 channel 2 VP position
248 Loop 2 channel 1 VP position
249 Loop 2 channel 2 VP position
251 Digital input lockout
252 Shunt cal loop 1
253 Shunt cal loop 2
254 Start clock
255 Stop clock

General configuration

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Calculated values availability	3383	D37h	N/A	N/A	uc
Instrument type (H/W dependent)	3384	D38h	N/A	N/A	it
1 Single loop gravimetric					
2 Single loop programmer					
3 Single loop controller					
4 Dual loop controller					
5 Ratio controller					
6 Ratio/Normal controller					
7 Ratio independent controller					
8 Derived input single loop controller					
9 Derived input dual loop controller					
10 Humidity controller					
11 Temperature and humidity controller					
12 Switcover dual ip single loop control					
13 Selectable ip single loop controller					
14 Maximum input single loop controller					
15 Minimum input single loop controller					
16 Cascade controller					
17 Zirconia controller					
18 Zirconia and independent controller					
19 Zirconia programmer					
20 Zirconia and independent programer					
21 Dual loop programmer					
22 Ratio/Normal programmer					
23 Ratio independent programmer					
24 Derived ip single loop programmer					
25 Derived input dual loop programmer					
26 Humidity programmer					
27 Temp and humidity programmer					
28 Switcover dual ip single loop prog					
29 Selectable ip single loop programer					
30 Maximum ip single loop programmer					
31 Minimum ip single loop programmer					
32 Cascade programmer					
33 Dual loop gravimetric					
34 Gravimetric and independent control					
JBUS resolution	3385	D39h	N/A	N/A	JR
0 Integer resolution					
1 Full resolution					
Comms parity	3386	D3Ah	N/A	N/A	JP
0 No parity					
1 Even parity					
2 Odd parity					
Prog logic register 1 1st input	3387	D3Bh	N/A	N/A	z1
Prog logic register 1 1st input inverse	3388	D3Ch	N/A	N/A	z1
Prog logic register 1 2nd input	3389	D3Dh	N/A	N/A	z1

General configuration - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Prog logic register 1 2nd input inverse	3390	D3Eh	N/A	N/A	z1
Prog logic register 1 operator	3391	D3Fh	N/A	N/A	z1
Prog logic register 1 output	3392	D40h	N/A	N/A	z1
Prog logic register 2 1st input	3393	D41h	N/A	N/A	z2
Prog logic register 2 1st input inverse	3394	D42h	N/A	N/A	z2
Prog logic register 2 2nd input	3395	D43h	N/A	N/A	z2
Prog logic register 2 2nd input inverse	3396	D44h	N/A	N/A	z2
Prog logic register 2 operator	3397	D45h	N/A	N/A	z2
Prog logic register 2 output	3398	D46h	N/A	N/A	z2
Prog logic register 3 1st input	3399	D47h	N/A	N/A	z3
Prog logic register 3 1st input inverse	3400	D48h	N/A	N/A	z3
Prog logic register 3 2nd input	3401	D49h	N/A	N/A	z3
Prog logic register 3 2nd input inverse	3402	D4Ah	N/A	N/A	z3
Prog logic register 3 operator	3403	D4Bh	N/A	N/A	z3
Prog logic register 3 output	3404	D4Ch	N/A	N/A	z3
Prog logic register 4 1st input	3405	D4Dh	N/A	N/A	z4
Prog logic register 4 1st input inverse	3406	D4Eh	N/A	N/A	z4
Prog logic register 4 2nd input	3407	D4Fh	N/A	N/A	z4
Prog logic register 4 2nd input inverse	3408	D50h	N/A	N/A	z4
Prog logic register 4 operator	3409	D51h	N/A	N/A	z4
Prog logic register 4 output	3410	D52h	N/A	N/A	z4
Prog logic register 5 1st input	3411	D53h	N/A	N/A	z5
Prog logic register 5 1st input inverse	3412	D54h	N/A	N/A	z5
Prog logic register 5 2nd input	3413	D55h	N/A	N/A	z5
Prog logic register 5 2nd input inverse	3414	D56h	N/A	N/A	z5
Prog logic register 5 operator	3415	D57h	N/A	N/A	z5
Prog logic register 5 output	3416	D58h	N/A	N/A	z5
Prog logic register 6 1st input	3417	D59h	N/A	N/A	z6
Prog logic register 6 1st input inverse	3418	D5Ah	N/A	N/A	z6
Prog logic register 6 2nd input	3419	D5Bh	N/A	N/A	z6
Prog logic register 6 2nd input inverse	3420	D5Ch	N/A	N/A	z6
Prog logic register 6 operator	3421	D5Dh	N/A	N/A	z6
Prog logic register 6 output	3422	D5Eh	N/A	N/A	z6
Prog logic register 7 1st input	3423	D5Fh	N/A	N/A	z7
Prog logic register 7 1st input inverse	3424	D60h	N/A	N/A	z7
Prog logic register 7 2nd input	3425	D61h	N/A	N/A	z7
Prog logic register 7 2nd input inverse	3426	D62h	N/A	N/A	z7
Prog logic register 7 operator	3427	D63h	N/A	N/A	z7
Prog logic register 7 output	3428	D64h	N/A	N/A	z7
Prog logic register 8 1st input	3429	D65h	N/A	N/A	z8
Prog logic register 8 1st input inverse	3430	D66h	N/A	N/A	z8
Prog logic register 8 2nd input	3431	D67h	N/A	N/A	z8
Prog logic register 8 2nd input inverse	3432	D68h	N/A	N/A	z8
Prog logic register 8 operator	3433	D69h	N/A	N/A	z8
Prog logic register 8 output	3434	D6Ah	N/A	N/A	z8
Prog logic register 9 1st input	3435	D6Bh	N/A	N/A	z9

General configuration - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Prog logic register 9 1st input inverse	3436	D6Ch	N/A	N/A	z9
Prog logic register 9 2nd input	3437	D6Dh	N/A	N/A	z9
Prog logic register 9 2nd input inverse	3438	D6Eh	N/A	N/A	z9
Prog logic register 9 operator	3439	D6Fh	N/A	N/A	z9
Prog logic register 9 output	3440	D70h	N/A	N/A	z9
Prog logic register 10 1st input	3441	D71h	N/A	N/A	za
Prog logic register 10 1st input inverse	3442	D72h	N/A	N/A	za
Prog logic register 10 2nd input	3443	D73h	N/A	N/A	za
Prog logic register 10 2nd input inverse	3444	D74h	N/A	N/A	za
Prog logic register 10 operator	3445	D75h	N/A	N/A	za
Prog logic register 10 output	3446	D76h	N/A	N/A	za
Prog logic register 11 1st input	3447	D77h	N/A	N/A	zb
Prog logic register 11 1st input inverse	3448	D78h	N/A	N/A	zb
Prog logic register 11 2nd input	3449	D79h	N/A	N/A	zb
Prog logic register 11 2nd input inverse	3450	D7Ah	N/A	N/A	zb
Prog logic register 11 operator	3451	D7Bh	N/A	N/A	zb
Prog logic register 11 output	3452	D7Ch	N/A	N/A	zb
Prog logic register 12 1st input	3453	D7Dh	N/A	N/A	zc
Prog logic register 12 1st input inverse	3454	D7Eh	N/A	N/A	zc
Prog logic register 12 2nd input	3455	D7Fh	N/A	N/A	zc
Prog logic register 12 2nd input inverse	3456	D80h	N/A	N/A	zc
Prog logic register 12 operator	3457	D81h	N/A	N/A	zc
Prog logic register 12 output	3458	D82h	N/A	N/A	zc
Programmable logic availability	3459	D83h	N/A	N/A	uc
User screens availability	3460	D84h	N/A	N/A	uc

Calibration parameters

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
RT calibration high point (mV)	3501	DADh	3505	DB1h	cp
RT calibration high ADC reading	3502	DAEh	3506	DB2h	cp
RT calibration low point (mV)	3503	DAFh	3507	DB3h	cp
RT calibration low ADC reading	3504	DB0h	3508	DB4h	cp
Shut valve calibration point	3509	DB5h	3510	DB6h	sv
Open valve calibration point	3511	DB7h	3512	DB8h	ov
Shut valve calibration reading	3513	DB9h	3514	DBAh	sr
Open valve calibration reading	3515	DBBh	3516	DBCh	or
Loop calibration request	3517	DBDh	3518	DBEh	lr
0 Calibration stopped					
1 -20/+100 input voltage calibration					
2 -10/+50 input voltage calibration					
3 -20/+20 input voltage calibration					
4 -8/+8 input voltage calibration					
5 RT calib (volts measured externally)					
6 RT calib (volts measured internally)					
7 High level input calibration					
8 CJC calibration					
9 Perform low calibration					
10 Perform high calibration					
11 Copy loop calibrations from nonvol					
12 Confirm copy loop calibs from nonvol					
13 Acknowledge loop calibration					
Loop calibration status	3519	DBFh	3520	DC0h	ls
0 Not calibrating					
1 Ready 2 point calibrate					
2 Busy high calibration					
3 Busy low calibration					
4 Busy cjc calibration					
5 Calibration complete					
6 Ready to copy from nonvol					
7 Zero offset error					
8 Low calibration error					
9 High calibration error					
10 Calibration input too noisy					
11 External input out of range					
12 Hardware failure					
13 Input count zero					
14 CJC input error					
Loop calibration value	3521	DC1h	3522	DC2h	lv

Calibration parameters - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Module calibration request	3523	DC3h	N/A	N/A	mr
0 Module calibration stopped					
1 Perform low input calibration					
2 Perform high input calibration					
3 Perform low output calibration					
4 Perform high output calibration					
5 Read value					
6 Acknowledge module calibration					
7 Recover module backup calibrations					
8 Recover all default calibrations					
9 Initialise all backup calibrations					
10 Confirm backup recovery					
11 Confirm default recovery					
12 Confirm backup initialisation					
Module calibration status	3524	DC4h	N/A	N/A	ms
0 Module not calibrating					
1 Module output calibration					
2 Module input calibration					
3 Module output ready					
4 Module calibration complete					
5 Module zero offset error					
6 Module low calibration error					
7 Module high calibration error					
8 Module calibration input too noisy					
9 Module external input out of range					
10 Module hardware failure					
11 Module input count zero					
12 Module hardware not found					
13 Ready to get backup module calib					
14 Ready to get default calibrations					
15 Ready to initialise backup calib					
Module calibration value	3525	DC5h	N/A	N/A	mv
CJC calibration slope	3526	DC6h	3527	DC7h	cj
DC output 1 low calibration	3528	DC8h	N/A	N/A	co
DC output 2 low calibration	3529	DC9h	N/A	N/A	co
DC output 3 low calibration	3530	DCAh	N/A	N/A	co
DC output 4 low calibration	3531	DCBh	N/A	N/A	co
DC output 5 low calibration	3532	DCCh	N/A	N/A	co
DC output 6 low calibration	3533	DCDh	N/A	N/A	co
DC output 1 high calibration	3534	DCEh	N/A	N/A	co
DC output 2 high calibration	3535	DCFh	N/A	N/A	co
DC output 3 high calibration	3536	DD0h	N/A	N/A	co
DC output 4 high calibration	3537	DD1h	N/A	N/A	co
DC output 5 high calibration	3538	DD2h	N/A	N/A	co
DC output 6 high calibration	3539	DD3h	N/A	N/A	co
Remote input high calibration	3540	DD4h	3542	DD6h	cr

Calibration parameters - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Remote input low calibration	3541	DD5h	3543	DD7h	cr
Millivolt input -8/8 low calibration	3544	DD8h	3548	DDCh	ct
Millivolt input -20/20 low calibration	3545	DD9h	3549	DDDh	ct
Millivolt input -10/50 low calibration	3546	DDAh	3550	DDEh	ct
Millivolt input -20/100 low calibration	3547	DDBh	3551	DDFh	ct
Millivolt input -8/8 high calibration	3552	DE0h	3556	DE4h	ct
Millivolt input -20/20 high calibration	3553	DE1h	3557	DE5h	ct
Millivolt input -10/50 high calibration	3554	DE2h	3558	DE6h	ct
Millivolt input -20/100 high calibration	3555	DE3h	3559	DE7h	ct
High level input high calibration	3560	DE8h	3561	DE9h	hl
High level input low calibration	3562	DEAh	3563	DEBh	hl
Gravimetric full Weight %	3564	DECh	3565	DEDh	GH
Gravimetric empty Weight %	3566	DEEh	3567	DEFh	GL
Gravimetric display resolution 0 0 decimal places 1 1 decimal place 2 2 decimal places 3 3 decimal places	3568	DF0h	3569	DF1h	gr
Gravimetric hopper adaptive fill rate	3570	DF2h	3571	DF3h	GA
Gravimetric adaptive fill time	3572	DF4h	3573	DF5h	Ga
Gravimetric blockage clearance cycles	3574	DF6h	3575	DF7h	GB
Gravimetric valve shut time	3576	DF8h	3577	DF9h	Gb
Gravimetric hopper volume	3578	DFAh	3579	DFBh	gv
Gravimetric percent to RPM scaler	3580	DFCh	3581	DFDh	GZ
Gravimetric empty hopper strategy 0 No change 1 Set output level	3582	DFEh	3583	DFFh	GG

Programmer parameters

The 900 EPC allows the definition of up to 20, (or 50) programmes, each configurable to the users needs.

Programmes are defined and controlled with three separate groups of parameters.

Programme Control Parameters define which programme is loaded and its status. They also have information on the size of the programmes.

Programme General Parameters are six words that define the programme type and its functions. (E.g. servo start, ramp type, resolution, holdback type, etc.)

Programme Segment Parameters contain the details of programme segments such as segment type, target set-point, segment rate or duration, digital output states, holdback type and value.

JBUS communications provide parameter addresses for 20 programs, each with a maximum length of 300 segments. Alternatively, for the 50 programme version, the maximum length of a programme is 100 segments. Each programme segment is defined by 8 words.

Note that it is not possible to use JBUS to communicate a programme larger than 300, (or 100) segments.

Programme download procedures

A download of a programme to a slave must be preceded with the writing of the programme general parameters. These will be used to verify the segment data that follows.

Segments are downloaded either by a write to an individual word (function code 6) or by writing to a number of words (function code 16).

Segments are inserted by changing the current end segment type from END to either STEP, CALL, RAMP, or DWELL. This will cause the end segment to shift 8 addresses down the map and insert the segment type specified. Segments can only be inserted at the end of the programme.

Segments are deleted by changing the segment type from STEP, CALL, RAMP or DWELL to END. This will delete the segment specified by the address and all following segments. To delete an entire programme set the segment type of the first segment to END.

Segments are edited by writing the new value to the address of the segment. To change a RAMP to a STEP, write STEP to the location currently set to RAMP. The segment to be edited must be within an existing programme, writing to a segment address beyond the END segment will result in an error code 02, illegal data address.

Any unused segment addresses in programme memory will return the value -32768 (8000h) to indicate the address is not available. Any unused words in a programme segment will return the value 0 (0000h). For example, a target setpoint field in a dwell segment will return the value 0 and segment 101 in a 100 segment programme will return the value -32768.

Program download example

To follow this example the instrument must be configured as described below, or the download will fail. The example uses a 50 programme programmer, the programme segment addresses will be different if the instrument is a 20 programme programmer. Before following this example, make a record of the current settings in an instrument. This will enable the instrument to be returned to the original configuration.

For more detail, particularly on how to determine parameter addresses, refer to the sections on Programme Control Parameters and Programme Segment Parameters.

INST CONFIG			
INST TYPE	DUAL LP PROG		
PROCESS I/PS			
LINEAR DEFN	LOOP1	J T/C	
	LOOP2	J T/C	
DISPLAY RANGE	LOOP1	MAX	1200.0
		MIN	0.0
		1 DEC PLACE	
	LOOP2	MAX	1200.0
		MIN	0.0
		1 DEC PLACE	
USER CONFIG			
DIGITAL COMMS	JBUS SLAVE		
	NO PARITY		
	INTEGER RES		
PROG CONFIG	SUBPROGRAMS		
	HOLDBACK		
	PRG DIG OP		
	NO FAST RUN		
	50 PROGRAMS		

OPERATING MODE — Scroll list parameters for both loops are to be as follows;

SPH	1000.0
SPL	0.0
HO1	100.0
HO2	100.0 (if heat/cool else LO1= 0.0)
Comms Address (level 3)	Address 19

Example:

To download a 5 segment (plus one end segment) programme, to programme 2 of the instrument at device address 19.

1) Write the Programme General Parameters;

This example uses function code 16 to download all the start data simultaneously
The same result could be achieved by 5 individual communications using function code 6.

Parameter Description	Data Value	Byte	JBUS Address	
	hex		dec	hex
Programme 2				
Programme type 0 Programme	00h	MSB	5509	1585h
Servo start type 1 Servo from SP	01h	LSB		
Ramp type definition 0 Ramp rate	00h	MSB	5510	157Eh
Ramp time units 1 Minutes	01h	LSB		
Ramp rate resolution 1 1 1 decimal place	01h	MSB	5511	157Fh
Dwell time units 2 Hours	02h	LSB		
Target SP resolution 1 1 decimal place	01h	MSB	5512	1580h
Holdback type 2 High deviation	02h	LSB		
Holdback value (20)	0014h		5513	1581h
Programme mimic span No value sent (the factory default will be retained)				

Command:

Device address	Function code	Address of first word		Number of words to write		Number of data bytes	Data	CRC	
13	10	15	85	00	05	0A	See below	39	65

Data (01) for address 5509		Data (01) for address 5510		Data (258) for address 5511		Data (258) for address 5512		Data for address 5513	
00	01	00	01	01	02	01	02	00	14

Reply:

Device address	Function code	Address of first word		Number of words written		CRC	
13	10	15	85	00	05	16	9D

2) Write the Programme Segment Parameters.

2.1) Insert 5 segments

In this example we will use single word writes, (function code 6). The same result can be acheived using multiple word writes, (function code 16).

Note: 6801 is the first segment address of Prog 2 for 50 programme version only.

Parameter Description	Data Value hex	Byte	JBUS Address dec	JBUS Address hex
Programme 2, segment 1				
Segment type 1 Ramp	01h	MSB	6801	1A91h
Subprogram number (N/A)	00h	LSB		

Command:

Device address	Function code	Address of word		Value of word		CRC	
13	06	1A	91	01	00	DD	DD

Reply: (Same as command)

Parameter Description	Data Value hex	Byte	JBUS Address dec	JBUS Address hex
Programme 2, segment 2				
Segment type 2 Dwell	02h	MSB	6809	1A99h
Subprogram number (N/A)	00h	LSB		

Command:

Device address	Function code	Address of word		Value of word		CRC	
13	06	1A	99	02	00	5C	EF

Reply: (Same as command)

Parameter Description	Data Value	Byte	JBUS Address	
	hex		dec	hex
Programme 2, segment 3				
Segment type 3 Step	03h	MSB	6817	1AA1h
Subprogram number (N/A)	00h	LSB		

Command:

Device address	Function code	Address of word		Value of word		CRC	
13	06	1A	A1	03	00	DC	B2

Reply: (Same as command)

Parameter Description	Data Value	Byte	JBUS Address	
	hex		dec	hex
Programme 2, segment 4				
Segment type 2 Dwell	02h	MSB	6825	1AA9h
Subprogram number (N/A)	00h	LSB		

Command:

Device address	Function code	Address of word		Value of word		CRC	
13	06	1A	A9	02	00	5C	E0

Reply: (Same as command)

Parameter Description	Data Value	Byte	JBUS Address	
	hex		dec	hex
Programme 2, segment 5				
Segment type 1 Step	01h	MSB	6833	1AB1h
Subprogram number (N/A)	00h	LSB		

Command:

Device address	Function code	Address of word		Value of word		CRC	
13	06	1A	A9	02	00	5C	E0

Reply: (Same as command)

2.2) Set the target setpoint for ramp 1

Parameter Description	Data Value hex	Byte	JBUS Address dec	JBUS Address hex
Programme 2, segment 1				
Target setpoint (1000.0)	03E8h		6802	1A92h

Command:

Device address	Function code	Address of word		Value of word		CRC	
13	06	1A	92	03	E8	2C	F3

Reply: (Same as command)

3) Delete the last segment. This is acheived by setting the segment type to End.

Parameter Description	Data Value hex	Byte	JBUS Address dec	JBUS Address hex
Programme 2, segment 5				
Segment type 0 End	00h	MSB	6833	1AB1h
Subprogram number (N/A)	00h	LSB		

Command:

Device address	Function code	Address of word		Value of word		CRC	
13	06	1A	B1	00	00	DD	87

Reply: (Same as command)

4) To delete ALL segments in a programme. This is done by setting the first segment type to End.

Parameter Description	Data Value hex	Byte	JBUS Address dec	JBUS Address hex
Programme 2, segment 1				
Segment type 0 End	00h	MSB	6801	1A91h
Subprogram number (N/A)	00h	LSB		

Command:

Device address	Function code	Address of word		Value of word		CRC	
13	06	1A	91	00	00	DC	4D

Reply: (Same as command)

Programmer control parameters

Programme Control Parameters define which programme is loaded and its status. They also have information on the size of the programmes.

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Current loaded program 0 None 1 Programme 1 to to 50 Programme 50	5001	1389h	5101	13EDh	CP
Current program segment	5002	138Ah	5102	13EEh	CS
Current segment type 0 End 1 Ramp 2 Dwell 3 Step 4 Call	5003	138Bh	5103	13EFh	PT
Current subprogram segment	5004	138Ch	5104	13F0h	SS
Current subprog segment type (as 5003)	5005	138Dh	5105	13F1h	ST
Target setpoint	5006	138Eh	5106	13F2h	TG
Current programmer setpoint	5007	138Fh	5107	13F3h	PW
Time remaining in current segment	5008	1390h	5108	13F4h	TM
Current ramp rate	5009	1391h	5109	13F5h	PR
Selected program to load (as 5001)	5010	1392h	5110	13F6h	PS
Overshoot inhibition	5011	1393h	5111	13F7h	OI
Power fail PV servo level	5012	1394h	5112	13F8h	PL
Power fail PV reset level	5013	1395h	5113	13F9h	PL
Program loader error 0 None 1 Loading 2 Program does not exist 3 Program type is subprogram 4 Subprogram does not exist 5 Subprogram type is program 6 Target setpoint too high 7 Target setpoint too low 8 End setpoint too high 9 End setpoint too low 10 Incompatible ends 11 Not pid no output power 12 Programmer not reset 13 Output power too high 14 Output power too low 15 Illegal segment type 16 Subprogram call within subprogram	5014	1396h	5114	13FAh	LE
Program segment with load error	5015	1397h	5115	13FBh	bp
Subprogram segment with load error	5016	1398h	5116	13FCh	bs
Current subprogram number	5017	1399h	5117	13FDh	SN

Programme status and size parameters

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Programmer status word (see SWD)	5201	1451h	N/A	N/A	WP
Prog digital output status word (see SWD)	5202	1452h	N/A	N/A	WD
Program cycles	5203	1453h	N/A	N/A	Lc
Program cycles remaining	5204	1454h	N/A	N/A	Lr
Sub-program cycles remaining	5205	1455h	N/A	N/A	Ls
Power fail recovery strategy 0 continue 1 Reset program 2 Servo and continue 3 Test PV deviation 4 Test time duration 5 Hold test time	5206	1456h	N/A	N/A	FD
Power fail servo duration	5207	1457h	N/A	N/A	PD
Power fail reset duration	5208	1458h	N/A	N/A	PD
Free program segments	5209	1459h	N/A	N/A	FS
Number of segments in program 1	5210	145Ah	N/A	N/A	PA
Number of segments in program 2	5211	145Bh	N/A	N/A	PA
Number of segments in program 3	5212	145Ch	N/A	N/A	PA
Number of segments in program 4	5213	145Dh	N/A	N/A	PA
Number of segments in program 5	5214	145Eh	N/A	N/A	PA
Number of segments in program 6	5215	145Fh	N/A	N/A	PA
Number of segments in program 7	5216	1460h	N/A	N/A	PA
Number of segments in program 8	5217	1461h	N/A	N/A	PA
Number of segments in program 9	5218	1462h	N/A	N/A	PA
Number of segments in program 10	5219	1463h	N/A	N/A	PA
Number of segments in program 11	5220	1464h	N/A	N/A	PA
Number of segments in program 12	5221	1465h	N/A	N/A	PA
Number of segments in program 13	5222	1466h	N/A	N/A	PA
Number of segments in program 14	5223	1467h	N/A	N/A	PA
Number of segments in program 15	5224	1468h	N/A	N/A	PA
Number of segments in program 16	5225	1469h	N/A	N/A	PA
Number of segments in program 17	5226	146Ah	N/A	N/A	PA
Number of segments in program 18	5227	146Bh	N/A	N/A	PA
Number of segments in program 19	5228	146Ch	N/A	N/A	PA
Number of segments in program 20	5229	146Dh	N/A	N/A	PA
Number of segments in program 21	5230	146Eh	N/A	N/A	PA
Number of segments in program 22	5231	146Fh	N/A	N/A	PA
Number of segments in program 23	5232	1470h	N/A	N/A	PA
Number of segments in program 24	5233	1471h	N/A	N/A	PA
Number of segments in program 25	5234	1472h	N/A	N/A	PA
Number of segments in program 26	5235	1473h	N/A	N/A	PA
Number of segments in program 27	5236	1474h	N/A	N/A	PA
Number of segments in program 28	5237	1475h	N/A	N/A	PA
Number of segments in program 29	5238	1476h	N/A	N/A	PA
Number of segments in program 30	5239	1477h	N/A	N/A	PA
Number of segments in program 31	5240	1478h	N/A	N/A	PA

Programme status and size parameters - continued

Parameter Description	Loop 1 JBUS Address		Loop 2 JBUS Address		Bi-synch Mnemonic
	dec	hex	dec	hex	
Number of segments in program 32	5241	1479h	N/A	N/A	PA
Number of segments in program 33	5242	147Ah	N/A	N/A	PA
Number of segments in program 34	5243	147Bh	N/A	N/A	PA
Number of segments in program 35	5244	147Ch	N/A	N/A	PA
Number of segments in program 36	5245	147Dh	N/A	N/A	PA
Number of segments in program 37	5246	147Eh	N/A	N/A	PA
Number of segments in program 38	5247	147Fh	N/A	N/A	PA
Number of segments in program 39	5248	1480h	N/A	N/A	PA
Number of segments in program 40	5249	1481h	N/A	N/A	PA
Number of segments in program 41	5250	1482h	N/A	N/A	PA
Number of segments in program 42	5251	1483h	N/A	N/A	PA
Number of segments in program 44	5253	1485h	N/A	N/A	PA
Number of segments in program 45	5254	1486h	N/A	N/A	PA
Number of segments in program 46	5255	1487h	N/A	N/A	PA
Number of segments in program 47	5256	1488h	N/A	N/A	PA
Number of segments in program 48	5257	1489h	N/A	N/A	PA
Number of segments in program 49	5258	148Ah	N/A	N/A	PA
Number of segments in program 50	5259	148Bh	N/A	N/A	PA
Bad write segment number	5260	148Ch	N/A	N/A	bw

Programme general parameters

Programme General Parameters are six words that define the programme type and its functions. (E.g. servo start, ramp type, resolution, holdback type, etc.) Programme general parameters use the bi-synch composite mnemonic, PA.

The 900 EPC allows the definition of up to 20, (or 50) programmes. The general parameters for each programme have a defined address area. The tables below list JBUS parameter addresses for the first 10 programmes. The parameter addresses for any particular programme may be obtained from the following formula;

$$\text{JBUS parameter address} = 5500 + (8 * (P - 1)) + W$$

Where P = The required programme number, and W = The required word number from the table below.

For example; The JBUS parameter address of 'Ramp Time Units', (LSB of word number 2), for programme number 32 is given by;

$$5500 + (8 * (32 - 1)) + 2 = 5750$$

Ramp Time Units' will be obtained from the LSB of data from that address.
LSB' means the least significant byte and 'MSB' the most significant byte.

Programme General Parameters have the the following format;

Parameter Description	Word Number	Byte	JBUS Address	
			dec	hex
Programme 1				
Programme type	1	MSB	5501	157Dh
0 Programme				
1 Subprogramme				
Servo start type		LSB		
0 Servo from PV				
1 Servo from SP				
Ramp type definition	2	MSB	5502	157Eh
0 Ramp rate				
1 Time to target				
Ramp time units		LSB		
0 Seconds				
1 Minutes				
2 Hours				
Ramp rate resolution	3	MSB	5503	157Fh
0 0 decimal places				
1 1 decimal places				
2 2 decimal places				
3 3 decimal places				
Dwell time units		LSB		
0 Seconds				
1 Minutes				
2 Hours				
Target SP resolution	4	MSB	5504	1580h
0 0 decimal places				
1 1 decimal places				
2 2 decimal places				
3 3 decimal places				
Holdback type (if configured)		LSB		
0 None				
1 Band deviation				
2 High deviation				
3 Low deviation				
Holdback value	5		5505	1581h
Programme mimic span	6		5506	1582h
Not supported	7		5507	1583h
Not supported	8		5508	1584h

Parameter Description	Byte	JBUS Address	
		dec	hex
Programme 2			
Programme type	MSB	5509	1585h
Servo start type	LSB		
Ramp type definition	MSB	5510	1586h
Ramp time units	LSB		
Ramp rate resolution	MSB	5511	1587h
Dwell time units	LSB		
Target SP resolution	MSB	5512	1588h
Holdback type, if configured per program	LSB		
Holdback value		5513	1589h
Programme mimic span		5514	158Ah
Not supported		5515	158Bh
Not supported		5516	158Ch
Programme 3			
Programme type	MSB	5517	158Dh
Servo start type	LSB		
Ramp type definition	MSB	5518	158Eh
Ramp time units	LSB		
Ramp rate resolution	MSB	5519	158Fh
Dwell time units	LSB		
Target SP resolution	MSB	5520	1590h
Holdback type, if configured per program	LSB		
Holdback value		5521	1591h
Programme mimic span		5522	1592h
Not supported		5523	1593h
Not supported		5524	1594h
Programme 4			
Programme type	MSB	5525	1595h
Servo start type	LSB		
Ramp type definition	MSB	5526	1596h
Ramp time units	LSB		
Ramp rate resolution	MSB	5527	1597h
Dwell time units	LSB		
Target SP resolution	MSB	5528	1598h
Holdback type, if configured per program	LSB		
Holdback value		5529	1599h
Programme mimic span		5530	159Ah
Not supported		5531	1598h
Not supported		5532	159Ch

Parameter Description	Byte	JBUS Address	
		dec	hex
Programme 5			
Programme type	MSB	5533	159Dh
Servo start type	LSB		
Ramp type definition	MSB	5534	159Eh
Ramp time units	LSB		
Ramp rate resolution	MSB	5535	159Fh
Dwell time units	LSB		
Target SP resolution	MSB	5536	15A0h
Holdback type, if configured per program	LSB		
Holdback value		5537	15A1h
Programme mimic span		5538	15A2h
Not supported		5539	15A3h
Not supported		5540	15A4h
Programme 6			
Programme type	MSB	5541	15A5h
Servo start type	LSB		
Ramp type definition	MSB	5542	15A6h
Ramp time units	LSB		
Ramp rate resolution	MSB	5543	15A7h
Dwell time units	LSB		
Target SP resolution	MSB	5544	15A8h
Holdback type, if configured per program	LSB		
Holdback value		5545	15A9h
Programme mimic span		5546	15AAh
Not supported		5547	15ABh
Not supported		5548	15ACh
Programme 7			
Programme type	MSB	5549	15ADh
Servo start type	LSB		
Ramp type definition	MSB	5550	15AEh
Ramp time units	LSB		
Ramp rate resolution	MSB	5551	15AFh
Dwell time units	LSB		
Target SP resolution	MSB	5552	15B0h
Holdback type, if configured per program	LSB		
Holdback value		5553	15B1h
Programme mimic span		5554	15B2h
Not supported		5555	15B3h
Not supported		5556	15B4h

Parameter Description	Byte	JBUS Address	
		dec	hex
Programme 8			
Programme type	MSB	5557	15B5h
Servo start type	LSB		
Ramp type definition	MSB	5558	15B6h
Ramp time units	LSB		
Ramp rate resolution	MSB	5559	15B7h
Dwell time units	LSB		
Target SP resolution	MSB	5560	15B8h
Holdback type, if configured per program	LSB		
Holdback value		5561	15B9h
Programme mimic span		5562	15BAh
Not supported		5563	15BBh
Not supported		5564	15BCh
Programme 9			
Programme type	MSB	5565	15BDh
Servo start type	LSB		
Ramp type definition	MSB	5566	15BEh
Ramp time units	LSB		
Ramp rate resolution	MSB	5567	15BFh
Dwell time units	LSB		
Target SP resolution	MSB	5568	15C0h
Holdback type, if configured per program	LSB		
Holdback value		5569	15C1h
Programme mimic span		5570	15C2h
Not supported		5571	15C3h
Not supported		5572	15C4h
Programme 10			
Programme type	MSB	5573	15C5h
Servo start type	LSB		
Ramp type definition	MSB	5574	15C6h
Ramp time units	LSB		
Ramp rate resolution	MSB	5575	15C7h
Dwell time units	LSB		
Target SP resolution	MSB	5576	15C8h
Holdback type, if configured per program	LSB		
Holdback value		5577	15C9h
Programme mimic span		5578	15CAh
Not supported		5579	15CBh
Not supported		5580	15CCh

Programme segment parameters

JBUS communications provide parameter addresses for 20 programs, each with a maximum length of 300 segments. Alternatively, for the 50 programme version, the maximum length of a programme is 100 segments. Each programme segment is defined by 8 words.

Note that it is not possible to use JBUS to communicate a programme larger than 300, (or 100) segments.

The address space for programme segments has been divided among the 20, (or 50) programmes. Each set of 8 words has a unique base address as listed in the Programme segment parameter base address table. The first word is written to the base address, the second word to the next address, etc.

The parameter addresses for any particular segment may be obtained from the following formula;

JBUS parameter address = base address + (8 * (S - 1)) + (W - 1)

Take the base address from the Programme segment parameter base address table.

S = The required segment number, and W = The required word number from the following table.

For example; The JBUS parameter address of the holdback type, (word 7), for segment 10 of programme number 8, (for a 20 programme instrument), is given by;

22801 + (8 * (10 - 1)) + 6 = 22879

The holdback type will be obtained from the MSB of data from that address.

'LSB' means the least significant byte and 'MSB' the most significant byte.

Programme segment parameters have the following format;

Parameter Description	Word Number	Byte	JBUS Address	
			dec	hex
Programme 1, segment 1				
Segment type 0 End (End is a special case, see next table) 1 Ramp 2 Dwell 3 Step 4 Subprogramme	1	MSB	6001	1771h
Subprogram number (only if MSB = subprogramme call)		LSB		
Target setpoint (if not used leave blank)	2		6002	1772h
One of the following (depends on word 1) Ramp rate or Time to target or Dwell duration or Number of sub program cycles	3		6003	1773h
Programmer digital output	4		6004	1774h
Digital output change enable	5		6005	1775h
Holdback value (configured per segment)	6		6006	1776h
Holdback type (configured per segment) 0 None 1 Band deviation 2 High deviation 3 Low deviation	7	MSB	6007	1777h
Not used		LSB		
Not used	8		6008	1778h

The last segment in a programme will define the end segment type. In the case of the end segment the 8 words will be arranged in the following format:

Parameter Description	Word Number	Byte	JBUS Address	
			dec	hex
Programme 1, segment 10				
Segment type (End segment) 0 End	1	MSB	6073	17B9h
End segment type 0 Indefinite dwell 1 Ramp at rate to target 2 Ramp for time to target 3 Set output power 4 Reset with setpoint track 5 Reset without setpoint track 6 Sub programme end		LSB		
End level data	2		6074	17BAh
End time data	3		6075	17BBh
Programmer digital output	4		6076	17BCh
Digital output change enable	5		6077	17BDh
Not used	6		6078	17BEh
Not used	7		6079	17BFh
Not used	8		6080	17C0h

The two parameters, programmer digital output status and digital output change enable, are defined by the following table;

Programmer digital output: If the bit is clear, (0) output is inactive, if the bit is set, (1) the output is active
Digital output change enable: If the bit is clear, (0) change is disabled, if the bit is set, (1) change is enabled

Function Description	Bit	R/O or R/W
Prog digital output 1	0	R/O
Prog digital output 2	1	R/O
Prog digital output 3	2	R/O
Prog digital output 4	3	R/O
Prog digital output 5	4	R/O
Prog digital output 6	5	R/O
Prog digital output 7	6	R/O
Prog digital output 8	7	R/O
Prog digital output 9	8	R/O
Prog digital output 10	9	R/O
Prog digital output 11	10	R/O
Prog digital output 12	11	R/O
Bits not used	12-15	

Programme segment parameter base addresses

The addresses available for programme segments are divided between the programmes. Each programme has a unique base address as listed below;

Programme Number	JBUS Base Address			
	20 Programmes		50 Programmes	
	dec	hex	dec	hex
Programme 1	6001	1771h	6001	1771h
Programme 2	8401	20D1h	6801	1A91h
Programme 3	10801	2A31h	7601	1DB1h
Programme 4	13201	3391h	8401	20D1h
Programme 5	15601	3CF1h	9201	23F1h
Programme 6	18001	4651h	10001	2711h
Programme 7	20401	4FB1h	10801	2A31h
Programme 8	22801	5911h	11601	2D51h
Programme 9	25201	6271h	12401	3071h
Programme 10	27601	5BD1h	13201	3391h
Programme 11	30001	7531h	14000	36B0h
Programme 12	32401	7E91h	14801	39D1h
Programme 13	34801	87F1h	15601	3CF1h
Programme 14	37201	9151h	16401	4011h
Programme 15	39601	9AB1	17201	4331h
Programme 16	42001	A411h	18001	4651h
Programme 17	44401	AD71h	18801	4971h
Programme 18	46801	B541h	19601	4C91h
Programme 19	49201	C031h	20401	4FB1h
Programme 20	51601	C991h	21201	52D1h

Continued on next page for programmes 21 to 50

Programme Number	JBUS Base Address			
	20 Programmes		50 Programmes	
	dec	hex	dec	hex
Programme 21	N/A	N/A	22001	55F1h
Programme 22	N/A	N/A	22801	5911h
Programme 23	N/A	N/A	23601	5C31h
Programme 24	N/A	N/A	24401	5F51h
Programme 25	N/A	N/A	25201	6271h
Programme 26	N/A	N/A	26001	6591h
Programme 27	N/A	N/A	26801	68B1h
Programme 28	N/A	N/A	27601	6BD1h
Programme 29	N/A	N/A	28401	6EF1h
Programme 30	N/A	N/A	29201	7211h
Programme 31	N/A	N/A	30001	7531h
Programme 32	N/A	N/A	30801	7851h
Programme 33	N/A	N/A	31601	7671h
Programme 34	N/A	N/A	32401	7E91h
Programme 35	N/A	N/A	33201	81B1h
Programme 36	N/A	N/A	34001	84D1h
Programme 37	N/A	N/A	34801	87F1h
Programme 38	N/A	N/A	35601	8B11h
Programme 39	N/A	N/A	36401	8E31h
Programme 40	N/A	N/A	37201	9151h
Programme 41	N/A	N/A	38001	9471h
Programme 42	N/A	N/A	38801	9791h
Programme 43	N/A	N/A	39601	9AB1h
Programme 44	N/A	N/A	40401	9DD1h
Programme 45	N/A	N/A	41201	A0F1h
Programme 46	N/A	N/A	42001	A411h
Programme 47	N/A	N/A	42801	A731h
Programme 48	N/A	N/A	43601	AA51h
Programme 49	N/A	N/A	44401	AD71h
Programme 50	N/A	N/A	45201	B091h

Status word definitions

Status word parameters are used to communicate multiple bits of status information with only one word of data.

Status words are listed here in order of their Loop 1 JBUS address.

Loop Status Word JBUS Address: 51 Bi-synch mnemonic: WL

When the clear status, 0 is not obvious, this is given in brackets.

Status if the bit is set, 1 (Status if the bit is clear, 0)	Bit	R/O or R/W
Manual mode, (auto)	0	R/W
Remote setpoint, (local setpoint)	1	R/W
Ratio setpoint enabled, (normal operation)	2	R/W
Autotune active	3	R/W
Adaptive tune active	4	R/W
Gain scheduling active	5	R/W
Valve position input break	6	R/O
Process input break	7	R/O
Remote input break	8	R/O
Setpoint 2 active, (setpoint 1 active)	9	R/W
Output rate limit active	10	R/W
Setpoint rate limit active	11	R/W
Cascade loop 1 enabled	12	R/W
Ratio SP 2 active	13	R/W
Bits not used	14-15	

Scroll List Function Acess Control JBUS Address: 87 Bi-synch mnemonic: WF

If the bit is clear, (0) the function is R/W accessible, if the bit is set, (1) the function is hidden.

Function	Bit	R/O or R/W
Remote setpoint	0	R/W
Setpoint rate limit	1	R/W
Setpoint 2	2	R/W
Output rate limit	3	R/W
Standby	4	R/W
Timer	5	R/W
Cascade	6	R/W
Ratio	7	R/W
Ratio setpoint 2	8	R/W
Bits not used	9-15	

Level 1 Page Access Control JBUS Address: 88 Bi-synch mnemonic: WJ

If the bit is clear, (0) the function is R/W accessible, if the bit is set, (1) the function is hidden.

Function	Bit	R/O or R/W
Single loop control	0	R/W
Programmer	1	R/W
Program options	2	R/W
Running data (not loop dependent)	3	R/W
Program edit (not loop dependent)	4	R/W
Program load (not loop dependent)	5	R/W
Program status	6	R/W
Program control	7	R/W
Bargraph	8	R/W
Tuning	9	R/W
Alarms	10	R/W
Transducer scaling	11	R/W
Ratio (loop 1 only)	12	R/W
Totaliser	13	R/W
User screen type 2	14	R/W
User screen type 3	15	R/W

All unconfigured screens read as hidden.

Instrument Status Word JBUS Address: 2003 Bi-synch mnemonic: WS

When the clear status, (0) is not obvious, this is given in brackets.

Status if the bit is set, 1 (Status if the bit is clear, 0)	Bit	R/O or R/W
Front keys disabled	0	R/W
Digital inputs disabled	1	R/W
Digital comms read only See below	2	R/W
Comms retransmission status , N/A	3	
Digital comms IEEE format, (ASCII format)	4	R/W
Unacknowledged alarm	5	R/O
Keys driven by comms	6	R/W
Scheduler time function on	7	R/W
Clock status See bellow	8	R/W
Clock status See bellow	9	R/W
Parameter value has changed See below	10	R/W
Power fail log See bellow	11	R/W
Bit not used	12	
Bit not used	13	
Instrument mode See bellow	14	R/O
Instrument mode See bellow	15	R/O

Bit 2: Once digital comms has been disabled a digital input must be used to reenable full digital comms.

Clock Status

Function	Bit		R/O or R/W
	8	9	
Clock running	0	0	R/W
Clock stopped	0	1	R/W
Clock alterable	1	0	R/W
Clock stopped	1	1	R/W

Bit 10: If this bit is set it indicates that a parameter value has changed since the bit was last cleared. This change will be either be from front panel key entry or a parameter value update by Auto or Adaptive tune.

Bit 11: 0 indicates no power fail has occured since the the bit was last cleared.
1 indicates a power fail has occured since the bit was last cleared.

Instrument Mode

Function	Bit		R/O or R/W
	14	15	
Operating mode	0	0	R/W
Configuration mode	0	1	R/W
Standby mode	1	0	R/W

Digital Input Status (17 to 31) JBUS Address: 2004 Bi-synch mnemonic: WI (MSB)

If the bit is clear, (0) the input is not active, if the bit is set, (1) the input is active.

Function	Bit	R/O or R/W
Digital input 17 status	0	R/O
Digital input 18 status	1	R/O
Digital input 19 status	2	R/O
Digital input 20 status	3	R/O
Digital input 21 status	4	R/O
Digital input 22 status	5	R/O
Digital input 23 status	6	R/O
Digital input 24 status	7	R/O
Digital input 25 status *	8	R/O
Digital input 26 status *	9	R/O
Bits not used	10-15	

* Digital input 25 is the micro digital input 1
* Digital input 26 is the micro digital input 2

Digital Input Status (1 to 16) JBUS Address: 2005 Bi-synch mnemonic: WI (LSB)

If the bit is clear, (0) the input is not active, if the bit is set, (1) the input is active.

Function	Bit	R/O or R/W
Digital input 1 status	0	R/O
Digital input 2 status	1	R/O
Digital input 3 status	2	R/O
Digital input 4 status	3	R/O
Digital input 5 status	4	R/O
Digital input 6 status	5	R/O
Digital input 7 status	6	R/O
Digital input 8 status	7	R/O
Digital input 9 status	8	R/O
Digital input 10 status	9	R/O
Digital input 11 status	10	R/O
Digital input 12 status	11	R/O
Digital input 13 status	12	R/O
Digital input 14 status	13	R/O
Digital input 15 status	14	R/O
Digital input 16 status	15	R/O

Digital Output Status (17 to 31) JBUS Address: 2006 Bi-synch mnemonic: WO (MSB)

If the bit is clear, (0) the output is not active, if the bit is set, (1) the output is active.

Function	Bit	R/O or R/W
Digital output 17 status	0	R/O
Digital output 18 status	1	R/O
Digital output 19 status	2	R/O
Digital output 20 status	3	R/O
Digital output 21 status	4	R/O
Digital output 22 status	5	R/O
Digital output 23 status	6	R/O
Digital output 24 status	7	R/O
Bits not used	8-15	

Digital Output Status (1 to 16) JBUS Address: 2007 Bi-synch mnemonic: WO (LSB)

If the bit is clear, (0) the output is not active, if the bit is set, (1) the output is active.

Function	Bit	R/O or R/W
Digital output 1 status	0	R/O
Digital output 2 status	1	R/O
Digital output 3 status	2	R/O
Digital output 4 status	3	R/O
Digital output 5 status	4	R/O
Digital output 6 status	5	R/O
Digital output 7 status	6	R/O
Digital output 8 status	7	R/O
Digital output 9 status	8	R/O
Digital output 10 status	9	R/O
Digital output 11 status	10	R/O
Digital output 12 status	11	R/O
Digital output 13 status	12	R/O
Digital output 14 status	13	R/O
Digital output 15 status	14	R/O
Digital output 16 status	15	R/O

Alarm Status Word JBUS Address: 2066 Bi-synch mnemonic: WA

When the clear status, (0) is not obvious, this is given in brackets.

Status if the bit is set, 1 (Status if the bit is clear, 0)	Bit	R/O or R/W
Unacknowledged alarm 1, (acknowledge alarm 1)	0	R/O (W/O)
Unacknowledged alarm 2, (acknowledge alarm 2)	1	R/O (W/O)
Unacknowledged alarm 3, (acknowledge alarm 3)	2	R/O (W/O)
Unacknowledged alarm 4, (acknowledge alarm 4)	3	R/O (W/O)
Reset alarm log 1	4	W/O
Reset alarm log 2	5	W/O
Reset alarm log 3	6	W/O
Reset alarm log 4	7	W/O
Alarm 1 active	8	R/O
Alarm 2 active	9	R/O
Alarm 3 active	10	R/O
Alarm 4 active	11	R/O
Bits not used	12-15	

Latching alarms retain the unacknowledged status until they are cleared.
The example below illustrates the definition of the alarm status for alarm 1.

Alarm Status 1

Bit		Function	R/O or R/W
0	8		
0	0	No alarm	R/W
0	1	Active alarm that has been acknowledged	R/W
1	0	Alarm no longer active not yet acknowledged	R/W
1	1	Active alarm not yet acknowledged	R/W

Totaliser Status Word JBUS Address: 2084 Bi-synch mnemonic: WT

Function	Bit	R/O or R/W
Totaliser 1 output alarm	0	R/O
Totaliser 2 output alarm	1	R/O
Totaliser 3 output alarm	2	R/O
Totaliser 4 output alarm	3	R/O
Reset totaliser 1	4	W/O
Reset totaliser 2	5	W/O
Reset totaliser 3	6	W/O
Reset totaliser 4	7	W/O
Bits not used	8-15	

Programme Logic Register Status Word JBUS Address: 2101 Bi-synch mnemonic: WB

Function	Bit	R/O or R/W
Digital register 1	0	R/O
Digital register 2	1	R/O
Digital register 3	2	R/O
Digital register 4	3	R/O
Digital register 5	4	R/O
Digital register 6	5	R/O
Digital register 7	6	R/O
Digital register 8	7	R/O
Digital register 9	8	R/O
Digital register 10	9	R/O
Digital register 11	10	R/O
Digital register 12	11	R/O
Bits not used	12-15	

Level 2 Page Access Control JBUS Address: 2102 Bi-synch mnemonic: WK

If the bit is clear, (0) the function is R/W accessible, if the bit is set, (1) the function is hidden.

Function	Bit	R/O or R/W
Control 1	0	R/W
Control 2	1	R/W
Gain scheduling	2	R/W
Inputs	3	R/W
Communication	4	R/W
Timers	5	R/W
Setpoints	6	R/W
Outputs	7	R/W
Alarms	8	R/W
Tuning loop 1	9	R/W
Tuning loop 2	10	R/W
Program control	11	R/W
Running data	12	R/W
Program edit	13	R/W
Program load	14	R/W
Totaliser	15	R/W

Timer Status Word JBUS Address: 2161 Bi-synch mnemonic: WE

When the clear status, (0) is not obvious, this is given in brackets.

Status if the bit is set, 1 (Status if the bit is clear, 0)	Bit	R/O or R/W
Timer 1 actioning, timed out,	0	R/O
(timer waiting / not timed out)		
Timer 2 actioning, timed out,	1	R/O
(timer waiting / not timed out)		
Timer 3 actioning, timed out,	2	R/O
(timer waiting / not timed out)		
Timer 4 actioning, timed out,	3	R/O
(timer waiting / not timed out)		
Timer 1 triggered, timing, (waiting)	4	R/O
Timer 2 triggered, timing, (waiting)	5	R/O
Timer 3 triggered, timing, (waiting)	6	R/O
Timer 4 triggered, timing, (waiting)	7	R/O
Bits not used		8-15

Calculated Value Status Word JBUS Address: 2203 Bi-synch mnemonic: WC

If the bit is clear, (0) the calculated value is within range, if the bit is set, (1) the value is out of range.

Function	Bit	R/O or R/W
Calculated value status 1	0	R/O
Calculated value status 2	1	R/O
Calculated value status 3	2	R/O
Calculated value status 4	3	R/O
Calculated value status 5	4	R/O
Calculated value status 6	5	R/O
Calculated value status 7	6	R/O
Calculated value status 8	7	R/O
Calculated value status 9	8	R/O
Calculated value status 10	9	R/O
Calculated value status 11	10	R/O
Calculated value status 12	11	R/O
Bits not used	12-15	

Programmer Status Word JBUS Address: 5201 Bi-synch mnemonic: WP

When the clear status, (0) is not obvious, this is given in brackets.

Status if the bit is set, 1 (Status if the bit is clear, 0)	Bit	R/O or R/W
Bit not used	0	
Bit not used	1	
Power fail while running	2	R/O
Prog reset after power fail	3	R/O
Wait until loop 1	4	R/W
Wait until loop 2	5	R/W
Load loop 1 programme	6	R/W
Load loop 2 programme	7	R/W
Loop 1 skip segment, (no skip, always read as 0)	8	W/O
Loop 2 skip segment, (no skip, always read as 0)	9	W/O
Holdback disable	10	R/W
Hold has occurred	11	R/O
Holdback has occured	12	R/O
Instrument in holdback	13	R/O
Programmer status (See below)	14	R/W
Programmer status (See below)	15	R/W

Programmer Status

Function	Bit		R/O or R/W
	14	15	
Run programme	0	1	R/W
Reset programme	1	0	R/W
Hold programme	1	1	R/W

Programmer Digital Output Status Word JBUS Address: 5202 Bi-synch mnemonic: WD

If the bit is clear, (0) the output is not active, if the bit is set, (1) the output is active.

Function	Bit	R/O or R/W
Prog digital output 1	0	R/O
Prog digital output 2	1	R/O
Prog digital output 3	2	R/O
Prog digital output 4	3	R/O
Prog digital output 5	4	R/O
Prog digital output 6	5	R/O
Prog digital output 7	6	R/O
Prog digital output 8	7	R/O
Prog digital output 9	8	R/O
Prog digital output 10	9	R/O
Prog digital output 11	10	R/O
Prog digital output 12	11	R/O
Bits not used	12-15	

Bit addressable parameters

Loop status bit addresses

When the clear status, (0) is not obvious, this is given in brackets.

Status if the bit is set, 1 (Status if the bit is clear, 0)	Loop 1 JBUS Address		Loop 2 JBUS Address	
	dec	hex	dec	hex
Manual mode, (auto)	1	1h	101	65h
Remote setpoint, (local setpoint)	2	2h	102	66h
Ratio setpoint enabled, (normal operation)	3	3h	103	67h
Autotune active	4	4h	104	68h
Adaptive tune active	5	5h	105	69h
Gain scheduling active	6	6h	106	6Ah
Valve position input breaak	7	7h	107	6Bh
Process input break	8	8h	108	6Ch
Remote input break	9	9h	109	6Dh
Setpoint 2 active, (setpoint 1 active)	10	Ah	110	6Eh
Output rate limit active	11	Bh	111	6Fh
Setpoint rate limit active	12	Ch	112	70h
Cascade loop 1 enabled	13	Dh	113	71h
Ratio SP 2 active	14	Eh	114	72h
Remote power limit active	15	Fh	115	73h

General status bit addresses

When the clear status, (0) is not obvious, this is given in brackets.

Status if the bit is set, 1 (Status if the bit is clear, 0)	JBUS Address	
	dec	hex
Front keys disabled	201	C9h
Digital inputs disabled	202	CAh
Digital comms read only See below	203	CBh
Comms retransmission status, N/A	204	CCh
Digital comms IEEE format, (ASCII format)	205	CDh
Unacknowledged alarm	206	CEh
Keys to be driven by comms	207	CFh
Scheduler time function on	208	D0h
Clock in set the time mode	209	D1h
Clock stopped	210	D2h
Standby mode, (operating mode)	215	D7h
Configuration mode, (operating mode)	216	D8h
Timer 1 actioning, R/O	217	D9h
Timer 2 actioning, R/O	218	DAh
Timer 3 actioning, R/O	219	DBh
Timer 4 actioning, R/O	220	DCh
Timer 1 triggered, R/O	221	DDh
Timer 2 triggered, R/O	222	DEh
Timer 3 triggered, R/O	223	DFh
Timer 4 triggered, R/O	224	E0h

JBUS address 203: Once digital comms has been disabled by setting this bit, a digital input must be used to reenable full digital comms.

Alarm and totaliser status bit addresses

Parameter Description	JBUS Address	
	dec	hex
Alarm 1 historical	301	12Dh
Alarm 2 historical	302	12Eh
Alarm 3 historical	303	12Fh
Alarm 4 historical	304	130h
Alarm log 1 reset	305	131h
Alarm log 2 reset	306	132h
Alarm log 3 reset	307	133h
Alarm log 4 reset	308	134h
Alarm 1 active	309	135h
Alarm 2 active	310	136h
Alarm 3 active	311	137h
Alarm 4 active	312	138h
Bits not used	313 to 319	139h to 13Fh
Totaliser 1 output alarm	320	140h
Totaliser 2 output alarm	321	141h
Totaliser 3 output alarm	322	142h
Totaliser 4 output alarm	323	143h
Reset totaliser 1	324	144h
Reset totaliser 2	325	145h
Reset totaliser 3	326	146h
Reset totaliser 4	327	147h

Digital I/O status bit address

If the bit is clear, (0) the input/output is not active, if the bit is set, (1) the input/output is active.

Parameter Description	JBUS Address	
	dec	hex
Digital input 1	351	15Fh
Digital input 2	352	160h
Digital input 3	353	161h
Digital input 4	354	162h
Digital input 5	355	163h
Digital input 6	356	164h
Digital input 7	357	165h
Digital input 8	358	166h
Digital input 9	359	167h
Digital input 10	360	168h
Digital input 11	361	169h
Digital input 12	362	16Ah
Digital input 13	363	16Bh
Digital input 14	364	16Ch
Digital input 15	365	16Dh
Digital input 16	366	16Eh
Digital input 17	367	16Fh
Digital input 18	368	170h
Digital input 19	369	171h
Digital input 20	370	172h
Digital input 21	371	173h
Digital input 22	372	174h
Digital input 23	373	175h
Digital input 24	374	176h
Digital input 25	375	177h
Digital input 26	376	178h
Digital output 1	377	179h
Digital output 2	378	17Ah
Digital output 3	379	17Bh
Digital output 4	380	17Ch
Digital output 5	381	17Dh
Digital output 6	382	17Eh
Digital output 7	383	17Fh
Digital output 8	384	180h
Digital output 9	385	181h
Digital output 10	386	182h
Digital output 11	387	183h
Digital output 12	388	184h
Digital output 13	389	185h
Digital output 14	390	186h
Digital output 15	391	187h
Digital output 16	392	188h
Digital output 17	393	189h
Digital output 18	394	18Ah
Digital output 19	395	18Bh

Parameter Description	JBUS Address	
	dec	hex
Digital output 20	396	18Ch
Digital output 21	397	18Dh
Digital output 22	398	18Eh
Digital output 23	399	18Fh
Digital output 24	400	190h

Programmer status bit addresses

When the clear status, (0) is not obvious, this is given in brackets.

Status if the bit is set, 1 (Status if the bit is clear, 0)	JBUS Address	
	dec	hex
50 programmes, (20 programmes)	402	192h
Power fail while running	403	193h
Prog reset after power fail	404	194h
Wait until loop 1	405	195h
Wait until loop 2	406	196h
Load loop 1 programme request	407	197h
Load loop 2 programme request	408	198h
Loop 1 skip segment	409	199h
Loop 2 skip segment	410	19Ah
Holdback disable	411	19Bh
Hold has occurred	412	19Ch
Holdback has occured	413	19Dh
Instrument in holdback	414	19Eh
Programme reset	415	19Fh

If the bit is clear, (0) the output is not active, if the bit is set, (1) the output is active.

Status if the bit is set, 1 (Status if the bit is clear, 0)	JBUS Address	
	dec	hex
Programmer digital output 1	421	1A5h
Programmer digital output 2	422	1A6h
Programmer digital output 3	423	1A7h
Programmer digital output 4	424	1A8h
Programmer digital output 5	425	1A9h
Programmer digital output 6	426	1AAh
Programmer digital output 7	427	1ABh
Programmer digital output 8	428	1ACh
Programmer digital output 9	429	1ADh
Programmer digital output 10	430	1AEh
Programmer digital output 11	431	1AFh
Programmer digital output 12	432	1B0h

User interface addresses - level 1 page access

If the bit is clear, (0) the function is R/W accessible, if the bit is set, (1) the function is hidden.

Parameter Description	JBUS Address			
	dec	hex	dec	hex
Single loop control page	521	209h	541	21Dh
Programmer page	522	20Ah	542	21Eh
Programme running data page	523	20Bh	543	21Fh
Programme edit page	524	20Ch	544	220h
Programme load page	525	20Dh	545	221h
Programme status page	526	20Eh	546	222h
Programme control page	527	20Fh	547	223h
Bargraph page	528	210h	548	224h
Tuning page	529	211h	549	225h
Alarms page	530	212h	550	226h
Transducer scaling page	531	213h	551	227h
Ratio page	532	214h	552	228h
Totaliser page	533	215h	553	229h
User screen type 2 page	534	216h	554	22Ah
User screen type 3 page	535	217h	555	22Bh

User interface addresses - level 2 page access

If the bit is clear, (0) the function is R/W accessible, if the bit is set, (1) the function is hidden.

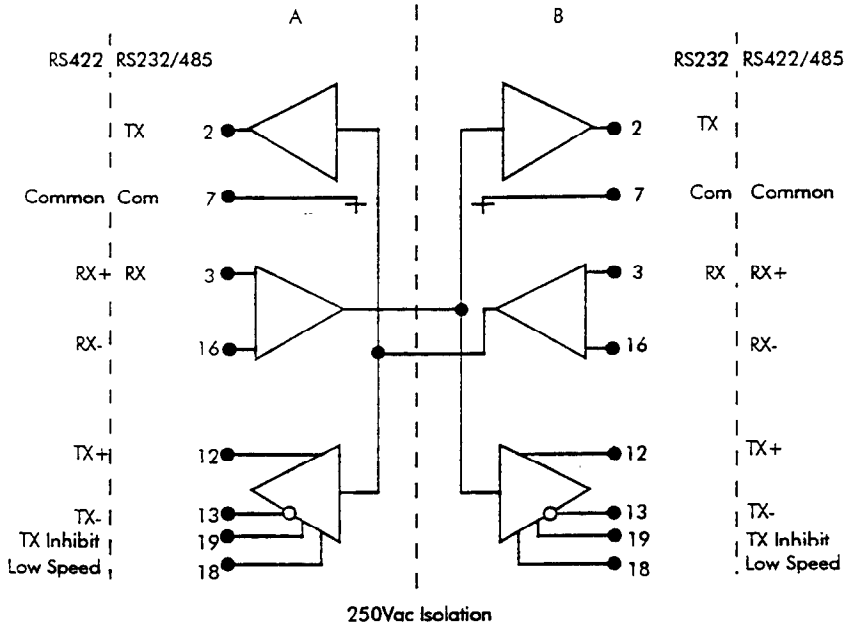
Parameter Description	JBUS Address	
	dec	hex
Control 1 page	561	231h
Control 2 page	562	232h
Gain scheduling page	563	233h
Inputs page	564	234h
Communication page	565	235h
Timers page	566	236h
Setpoint page	567	237h
Outputs page	568	238h
Alarms page	569	239h
Tuning page	570	23Ah
Programme control page	571	23Bh
Programme running data page	572	23Ch
Programme edit page	573	23Dh
Programme load page	574	23Eh
Totaliser page	575	23Fh
Calculated value page	576	240h
Programable logics page	577	241h
User screens page	578	242h

Appendix A GLOSSARY OF TERMS

ASCII	American Standards Committee for Information Interchange. In normal usage this refers to the character code defined by this committee for the exchange of information between devices.
Baud	The number of line signal variations per second. Used to indicate the rate at which data are transmitted on a line.
Bus	A common electrical network allowing devices, (computers, instruments) to communicate with each other.
CRC	Cyclic Redundancy Check. The CRC is an error check code and is two bytes, (16bits) long calculated from the preceding message. From a comparison of the calculated CRC and the received CRC the validity of the message can be determined.
d	Where there is the possiblity of confusion with hexadecimal numbers, decimal numbers are prefixed with 'd'. For example '256d'.
Duplex (full duplex)	A communication channel capable of operating in both directions simultaneously.
EIA	Electrical Industries Association, the standards body that has defined electrical requirements of communications systems such as RS232, RS422 and RS485.
EOT	The End of Transmission segment is a period of inactivity 3.5 times the single character transmission time. The EOT segment at the end of a message indicates to the listening device that the next transmission will be a new message and therefore a device address character.
h	Numbers in hexadecimal format are represented by the prefix 'h'. For example 'A2h' is the hexadecimal representation of 162 decimal.
Half duplex	A communication channel capable of operating in both directions, but not simultaneously.
Message frame	A message is made up of a number of characters sequenced so that the receiving device can understand. This structure is called a message frame.
MSB LSB	Most significant byte (or bit) Least significant byte (or bit)
Non synchronous	A data channel in which no timing information is transferred between communicating devices.
Parity	A mechanism used for the detection of transmission errors when single characters are being transmitted. A single binary digit known as the parity bit has a value of 0 or 1 depending on the number of ë1ís in a data message. This allows single bit error detection in the receiver.
RTU	Remote Terminal Unit. This refers to the code used for the exchange of information between devices.
RS232 RS422/485	This refers to the electrical standard used for signalling information on a serial communications link.
RX	Receiver on a communication bus.
Simplex	A communication channel capable of operating in one direction only.
TX	Transmitter on a communication bus.

Appendix B 261 FUNCTIONAL DIAGRAM

The 261 Universal Serial Interface provides electrical isolation between RS232 and RS422/485 serial links. Ports A and B support both RS232 and RS422/RS485.



RS232 Connections of the 261

Standard Cable Colour	PC socket pin no.		PC Function *	261 Terminal	261 Function
	9 way	25 way			
Black	2	3	Receive (RX)	2	Transmit (TX)
Clear	3	2	Transmit (TX)	3	Receive (RX)
Screen	5	7	Common	7	Common
Screen		1	Earth		

* These are the functions normally assigned to socket pins. Please check your PC manual to confirm.

RS422/485 Connections of the 261

Standard Cable Colour	PC socket pin no. 25 way	PC Function *	261 Terminal	261 Function
White	3	Receive (RX+)	12	Transmit (TX+)
Black	16	Receive (RX-)	13	Transmit (TX-)
Red	12	Transmit (TX+)	3	Receive (RX+)
Black	13	Transmit (TX-)	16	Receive (RX-)
Screen via 120ohm	7	Common	7	Common
Screen	1	Earth		

* These are the functions normally assigned to socket pins. Please check your PC manual to confirm.