CONTROLLER MODELS 2408*f* and 2404*f*

PROFIBUS-DP COMMUNICATIONS HANDBOOK

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CHAPTER 1 INTRODUCTION

This handbook is written for people who need to use a digital communications link and PROFIBUS-DP communication protocols to supervise Eurotherm Controls Series 2000 instruments. The PROFIBUS-DP protocol is supported by Eurotherm instruments carrying the suffix *f* in their order codes. Specifically 2408*f* and 2404*f* controllers.

It has been assumed that the reader has some experience of communication protocols and is familiar with Series 2000 instruments.

Related handbook:

- Installation and Operation Handbook for 2408 and 2404 Controller, Eurotherm part number HA025132. This gives a full description of how to use the instruments, configuration options and definition of parameters.

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

THE PROFIBUS FAMILY

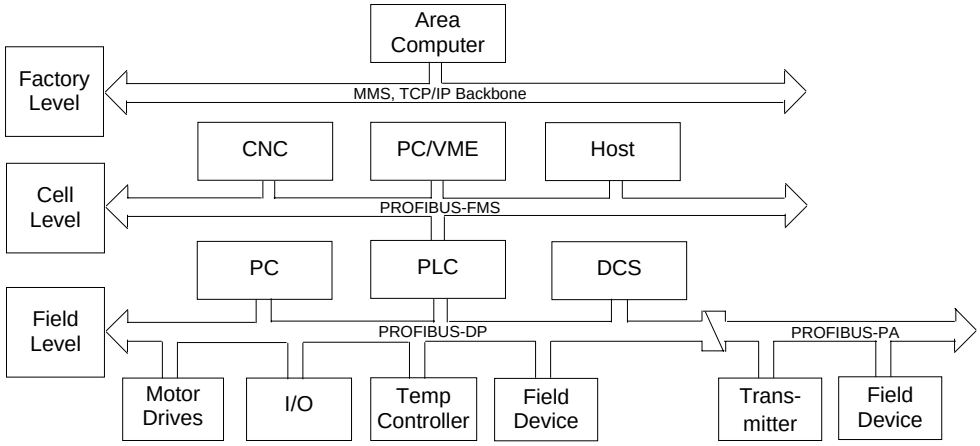


Figure 1-1: PROFIBUS Application Areas

PROFIBUS is a vendor independent, open fieldbus standard for a wide range of applications in manufacturing, process and building automation. Vendor independence and openness are guaranteed by the PROFIBUS standard EN50170. With PROFIBUS, devices from different manufacturers can inter-communicate. Suitable interfaces exist for PLCs, which include the Siemens, Mitsubishi and Allen Bradley range.

The 2400*f* controllers support the PROFIBUS-DP variant of the PROFIBUS protocol which is designed especially for communication between automatic control systems and distributed I/O at the device level. It is most often used to allow a central Programmable Logic Controller or PC based control system to use external 'slave' devices for I/O or specialised functions. The principal advantage is that these devices may be distributed around a machine, thereby saving on the cost of point to point wiring. The 'open' nature of the network also permits equipment from different manufacturers to be mixed on the same bus. Additionally, the off-loading of complex and specialised tasks such as PID temperature control lessens the processing load on the central PLC so that its other functions may be carried out more efficiently and require less CPU memory.

PROFIBUS-DP is described in DIN 19245 Part 3, and forms part of EN 50170 with P-Net and WorldFIP. However it is important to note that P-Net and WorldFIP are ***wholly incompatible*** with PROFIBUS, using different wiring and transmission technologies.

The PROFIBUS-DP network uses a high speed version of the RS485 standard, permitting baud rates of up to 12Mbaud. Note however, that in order to guarantee electrical isolation standards, the 2400*f* Series supports rates of up to 1.5 MBaud only. A table of network speed against segment length is given in Chapter 3.

A maximum of 32 PROFIBUS-DP stations (nodes) may be contained within a single network segment. Use of RS485 repeaters allows a total of up to 127 stations.

PROFIBUS-DP is a multimaster, master-slave, token passing network. More detailed information, including a detailed guide to products available, may be obtained from the various world wide PROFIBUS user organisations. You will find contact information in trade magazines or by reference to http://www.profibus.com on the World Wide Web.

PROFIBUS is available in two other types, aimed at different application areas, as follows:

PROFIBUS-PA is designed especially for process automation. It permits sensors and actuators to be connected on one common bus line even in intrinsically safe areas. PROFIBUS PA permits data communication and power over the bus, using intrinsically safe, 2-wire technology according to the international standard IEC 1158-2, but may also be used on the standard RS485 cabling for non-intrinsically safe applications.

PROFIBUS-FMS is the general purpose solution for communication tasks at the cell level.

2400*f* series controllers may be used on 'combi' networks which combine DP and FMS, but may only be used for PA when the intrinsically safe physical medium is not used.

CHAPTER 2 PRINCIPLES OF OPERATION

PROFIBUS-DP distinguishes between master devices and slave devices. It allows slave devices to be connected on a single bus thus eliminating considerable plant wiring typical with conventional communications systems. Figure 2-1 compares the two systems.

Master devices determine the data communication on the bus. A master can send messages without an external request when it holds the bus access rights (the token). Masters are also called active stations in the PROFIBUS protocol.

Slave devices are peripheral devices. Typical slave devices include input/output devices, valves, motor drives and measuring transmitters. The 2408*f* and 2404*f* series Temperature Controllers are intelligent slaves. This means they will only respond to a master when requested to do so.

PROFIBUS-DP is based around the idea of a 'cyclical scan' of devices on the network, during which 'input' and 'output' data for each device is exchanged.

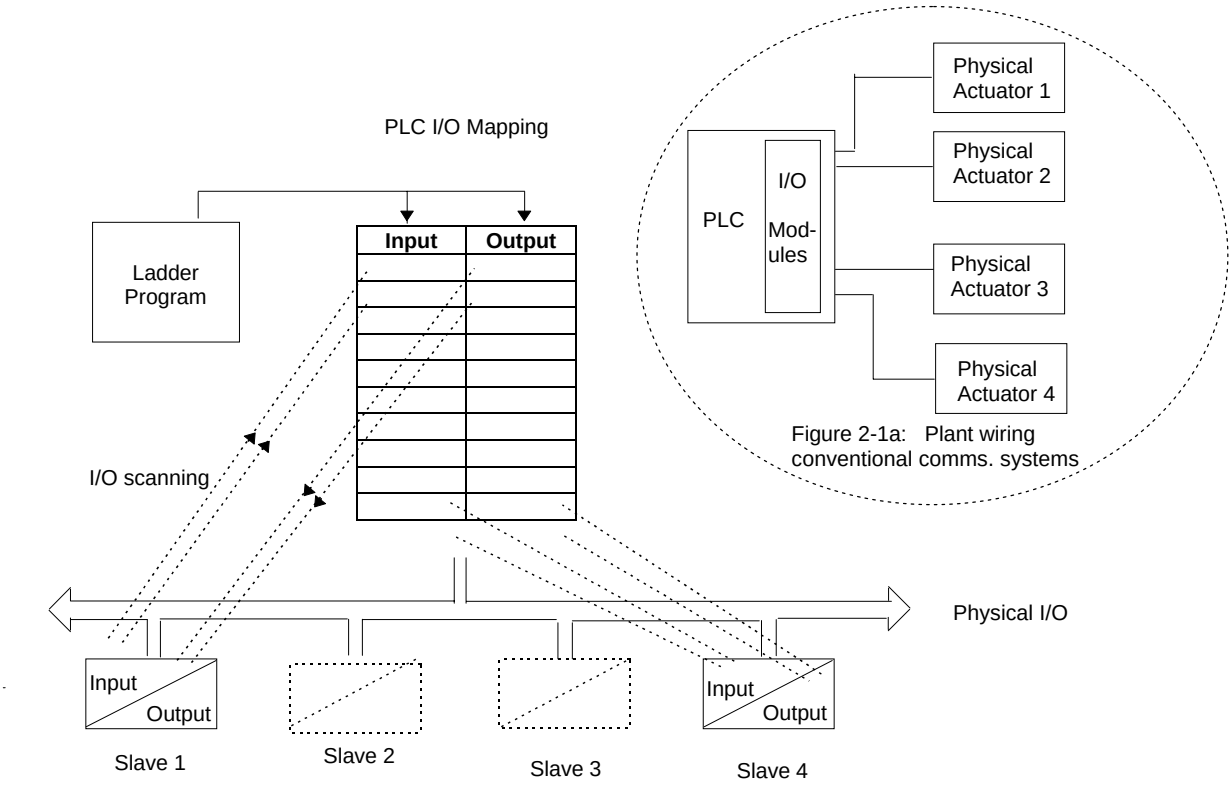


Figure 2-1: PROFIBUS compared with conventional comms. systems.

I/O Data Exchange

The process of reading the inputs and writing to the outputs is known as an I/O data exchange. Typically, the parameters from each slave device will be mapped to an area of PLC input and output registers, or a single function block, so that the controlling ladder logic or program interfaces with the device as if it were an internally fitted module. It is NOT necessary, therefore, for the programmer to know anything about the physical network. The process of network configuration is usually performed using a PC based program which allows the devices on the network to be defined and device parameters to be mapped into the PLC registers or function blocks.

The cyclical scan occurs in the following order:

1. Values from each slave device, 'Input Data', are first scanned over the network into a pre-defined set of input registers in the master controller. Such values might be a set of digital input readings for a digital input unit, or the measured temperature and alarm status from a PID controller.
2. The master then runs its control program, (such as a ladder logic program) using the input data read from the slave devices.
3. The master writes output values (output data) into a pre-defined set of output registers. For example, one of the digital inputs read in the input data might be used to select one of a set of setpoints to be sent to the PID controller.
4. These outputs are then written to each slave device, and the scan-process-write cycle repeats.

Typically no more than 32 bytes of input data and 32 bytes of output data are exchanged for each device during the data exchange. Some PLC masters allow no more than this, although the PROFIBUS-DP standard provides the possibility of transferring 236 bytes in each direction. The input and output data lengths for a given device are variable and it is possible to have devices with only input data, only output data, or both.

The input and output data mixture used by a given slave device is defined by what is known as a GSD file. See Chapter 5 for more details. For simple devices such as digital or analogue I/O blocks, this is fixed. However, since more complex devices often have a much wider choice of possible values to send, it is usually possible to edit the GSD file to change the mapping of device parameters onto Profibus inputs or outputs. This is the case with most Eurotherm implementations, which also allow access to parameter data not in the GSD Input/Output data file. This is called Demand Data and is described further in Chapter 7.

The GSD file is imported into the PROFIBUS Master Network Configuration software before the network is created.

NB: PROFIBUS Input Data = Values sent from a device to a master controller or PLC,
PROFIBUS Output Data = Values sent from a master controller or PLC to a device

CHAPTER 3 WIRING

RS485 is the transmission technology used in 2404*f* and 2408*f* PROFIBUS-DP controllers.
Connections are made to the rear terminal block as follows:

Controller Terminal	Designation	Function
HB	Shield	RF Ground for cable shielding
HC	VP	5 Volts for termination network only
HD	B/B	RXD/TXD positive
HE	A/A	RXD/TXD negative
HF	D Gnd	0 Volts for termination network only

Earthing the shield

The PROFIBUS standard suggests that both ends of the transmission line be connected to safety earth. If such a course is followed, care must be taken to ensure that differences in local earth potential do not allow circulating currents to flow, as these can not only induce large common mode signals in the data lines, but can also produce potentially dangerous heating in the cable. Where doubt exists, it is recommended that the shield be earthed at only one section of the network.

Do not connect the shield to DGND.

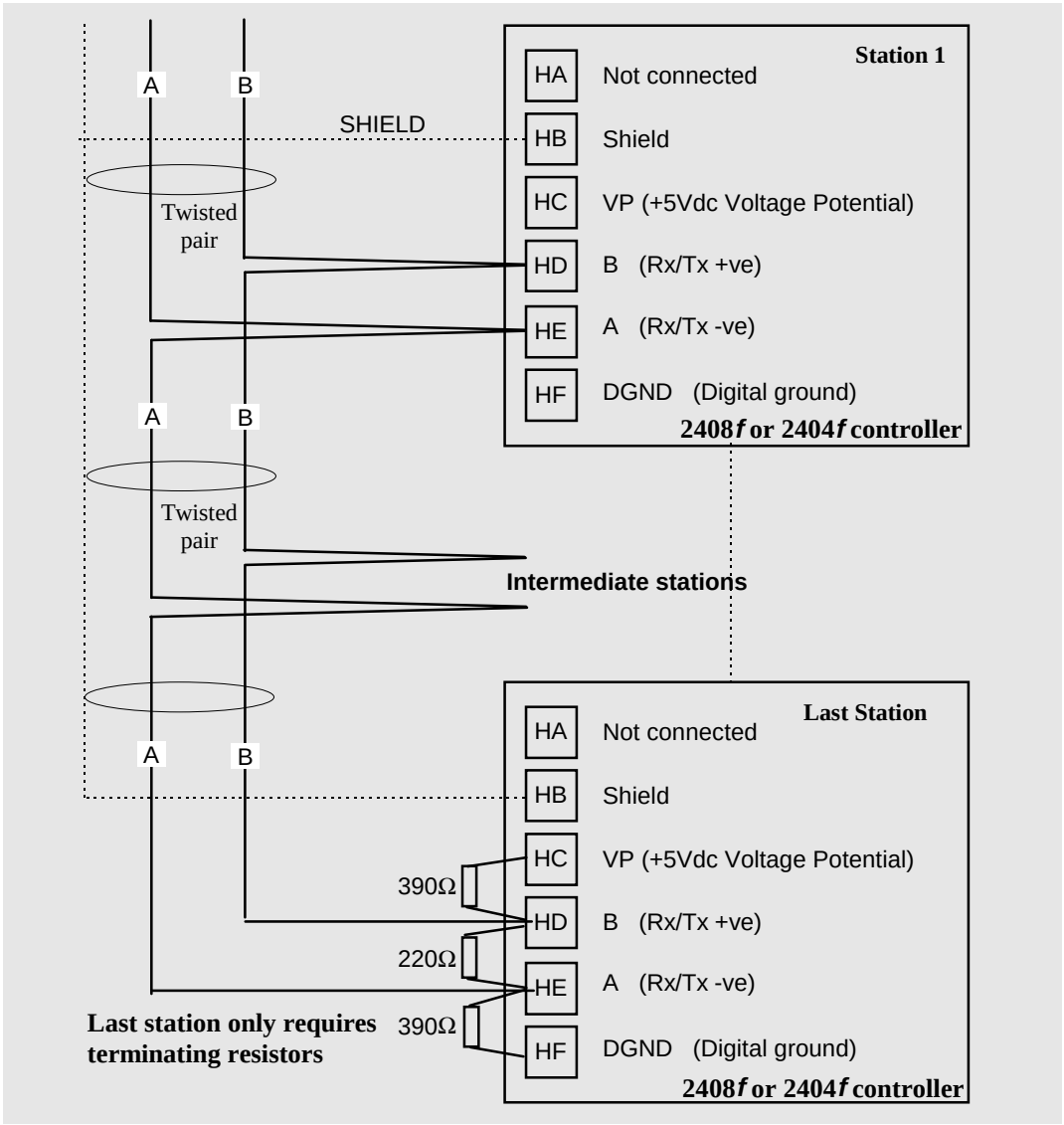


Figure 3-1: Connection Diagram for up to 32 Slaves.

CABLE SPECIFICATIONS

Either of the two cable types detailed below can be used. Please note that the cable types A and B, specified below, are NOT related to the wire numbers A and B in the above wiring diagram. Type A is recommended as it allows higher speed and longer cable length.

	Type A cable	**Type B cable**
Characteristic Impedance:	135 to 165Ω at a frequency of 3 to 20 MHz.	135 to 165Ω at a frequency of > 100 kHz
Cable capacitance:	< 30 pF per Metre	typ. < 60 pF per Metre
Core diameter:	max. 0.34 mm², corresponds to AWG 22	max. 0.22 mm², corresponds to AWG 24
Cable type:	twisted pair cable. 1x2 or 2x2 or 1x4 lines	twisted pair cable. 1x2 or 2x2 or 1x4 lines
Resistance:	< 110 Ohm per km	-
Shielding:	Copper shielding braid or shielding braid and shielding foil	Copper shielding braid or shielding braid and shielding foil

Belden B3079A meets cable A specifications, but there are other choices. For more information refer to the 'PROFIBUS Product Guide' produced by the PROFIBUS User Group.

Maximum line length per segment

Baud rate (kbit/sec)	9.6	19.2	93.75	187.5	500	1500
Type A cable	1200m	1200m	1200m	1000m	400m	200m
Type B cable	1200m	1200m	1200m	600m	200m	-

CHAPTER 4 CONTROLLER SET UP & NETWORK CONFIGURATION

PROFIBUS-DP communications is available in Eurotherm 2408*f* and 2404*f* controllers. Other 2000 series controllers (i.e. controllers without the *f* suffix) cannot be converted to PROFIBUS-DP comms, since a different microprocessor board is required.

Main Differences between 2400*f* Controllers and Other Series 2000 Instruments.

2400*f*
The 20 program variant is not available
EI Bisynch is not available. The Instrument Programming System software, IPSG, therefore, cannot be used for cloning or configuration.
Module slot H can only be used for PROFIBUS-DP or Modbus communications.
A PROFIBUS-DP module fitted to 2400*f* may be configured to Modbus communications if required. A Modbus module fitted to any other 2000 series instrument cannot be configured to PROFIBUS-DP.
A PDSIO master or slave module can only be fitted in module slot J.

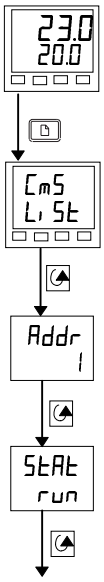
PROFIBUS-DP may be used with either mains powered and 24V AC/DC controllers, and in all respects, other than those described above, they are standard units and may be used in exactly the same way as other 2400 series controllers.

CONTROLLER NODE ADDRESS AND CONFIGURATION

Assigning a Node Address

Connect the controller to the PROFIBUS network as described in Chapter 3.

Every controller on the network must have its own unique address to distinguish it from any other.



From the HOME display,

press ⊡ until you reach the `CmS` list

From the Comms List

Press ⊡ to display the node address.
Press ⊡ or ⊡ to set the desired address. `0 - 126`

From the Address List

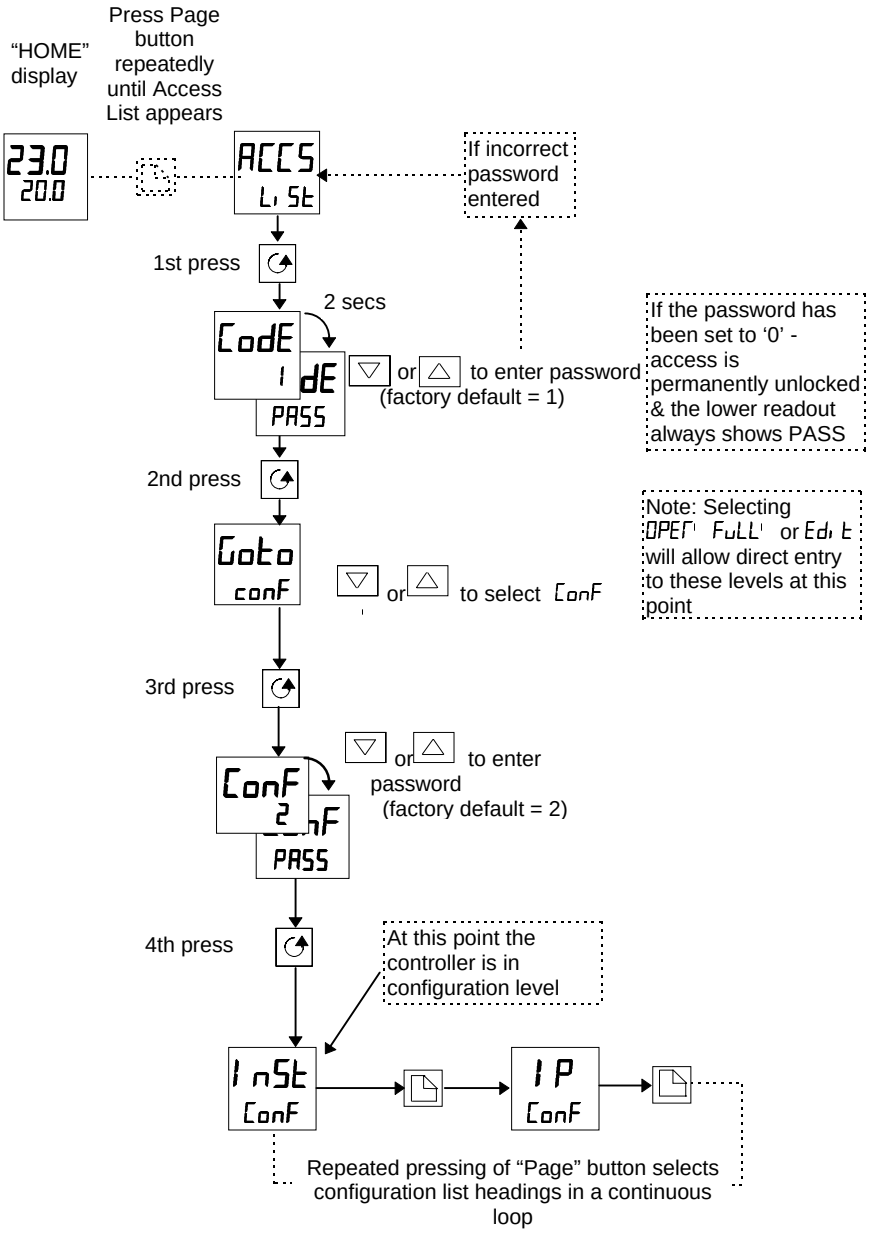
Press ⊡ to display the Comms Status
This is a read-only diagnostic display
`rdy` Ready to run
`run` Comms running

Press ⊡ to return to the HOME display

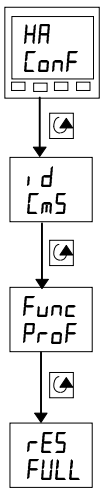
Note: The baud rate is automatically selected by the master.

TO CONFIGURE THE CONTROLLER COMMUNICATIONS PARAMETERS

Select Configuration Level



Select Comms Configuration List HA



Press to display: Identity of module

This should be a read-only parameter displaying cms

Press to display: Function

Press or to set Func = ProF. This selects PROFIBUS-DP protocol

Press to display: Comms Resolution

Press or to select FuLL = Full, or Int = Integer FuLL is the recommended setting

NETWORK CONFIGURATION

Having wired and configured the controller, the master PLC or PC based supervisory package must be configured to set-up the parameters that it will be able to read and write to. This is known as 'network configuration'.

The network is configured by importing 'GSD' files into your Master PROFIBUS network configuration software: This should be explained in your network configuration software documentation. 'GSD' is an acronym of a German phrase meaning 'Device Database'.

The GSD files supplied with your 2408*f* and 2404*f* controllers are created using a Windows-based configuration tool. This software is also separately available under ordering code PROF-ENG.
Two standard GSD files, are supplied on the disc:
EURO2400.GSD - standard parameter mapping. This is the default file, which is pre-configured for commonly used parameters, as shown in Table 4-1 below.
EURD2400.GSD - standard parameter mapping with 'demand data', which allows random read/write to any parameter within the controller. This is configured with the same default parameters.

PROFIBUS Input Data		PROFIBUS Output Data	
Process Variable	PV	Setpoint 1	SP 1
Working Setpoint	wSP	Setpoint 2	SP 2
Output 1	OP 1	Setpoint Select	SSEL
Summary Output Status Word		Acknowledge all Alarms	

Table 4-1: Default Parameters.

The Summary Output Status Word is shown in Table 4-2., see 'PROFIBUS DIAGNOSTICS'

It is possible to edit the above files or create new files using the Windows configurator.

The Master network configuration software uses the GSD files to produce a further file which is downloaded into your master PLC or PC supervisory package. Once the configuration file has been downloaded, you can set the network running. If all is well, the 'REM' beacon on the controller will start to flash, indicating that the data exchange is proceeding. The STAT parameter in the CMS list will show run. Input data will then be transferred from the controller to the master, and output data will be transferred from the master to the controller.

If all 2400*f* controllers are of the same type only one GSD file needs to be configured.

FLOATING POINT DATA FORMATS

Data is returned or sent in the form of a single 16 bit integer value (register). Since the controllers use and display floating point values, these are translated into integers in one of two ways, selected in controller configuration.

Full Resolution: The value is returned as a 'scaled integer', such that 999.9 is returned or sent as 9999; 12.34 is encoded as 1234. The control program in the PROFIBUS master must convert the numbers into floating point values if required. This is the recommended format and is the factory default.

Integer Resolution. The floating point value is returned as a rounded integer, with the fractional part discarded. For example 999.9 would be returned as 1000; 12.34 would be returned as 12. Similar rules apply to output operations, although note that it is only possible to send integer values so that setpoint values such as 11.5 cannot be used and so either 11 or 12 would have to be chosen instead.

PROFIBUS DIAGNOSTICS

One of the features of PROFIBUS-DP is that high priority diagnostic information is provided for each slave. The 2400*f* Series uses the 'Ext_Diag_Data' area of this message (bytes 7 and 8) to send a word containing 16 bits of information pertaining to the process and alarm status of the controller: The documentation supplied with your master should provide further details on how to access diagnostic information.

BIT	DESCRIPTION
0	Alarm 1 State (0 = Safe 1 = Alarm)
1	Alarm 2 State (0 = Safe 1 = Alarm)
2	Alarm 3 State (0 = Safe 1 = Alarm)
3	Alarm 4 State (0 = Safe 1 = Alarm)
4	Manual Mode (0 = Auto 1 = Manual)
5	Sensor Break (0 = Good PV 1 = Sensor Broken)
6	Loop Break (0 = Good closed loop 1 = Open Loop)
7	Heater Fail (0 = No Fault 1 = Load fault detected)
8	Tune Active (0 = Auto Tune disabled 1 = Auto Tune active)
9	Ramp/Program Complete (0 = Running/Reset 1 = Complete)
10	PV out of range (0 = PV within table range 1 = PV out of table range)
11	DC control module fault (0= Good. 1= BAD)
12	Programmer Segment Synchronise (0 = Waiting, 1 = Running)
13	Remote input sensor break (0 = Good, 1 = Bad)
14	IP1 Fault
15	Reserved

Table 4-2: Summary Output Status Word

A 'new diagnostics' event will occur whenever any of the monitored events changes state...

Diagnostics Example

The example below may be returned which gives a summary of the Output Status Word information shown in the table above.

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
XX	XX	24	XX	XX	03	40	30

Byte 6 signifies 3 bytes of information are included
Bytes 7 & 8 are 4030Hex or 01 00 00 00 00 11 00 00 Binary

From table 4-1:

Bit 4 is set Meaning the controller is in Manual Mode
Bit 5 is set Meaning the controller is in Sensor Break
Bit 14 is set Meaning the controller is in IP1 Fault

Global Commands

This is a further PROFIBUS-DP feature, which is not supported by the 2400f series of temperature controllers.

CHAPTER 5 THE WINDOWS CONFIGURATOR

The Windows Configurator creates a 'GSD' file which provides a simple way of mapping device parameters into the PLC or supervisory package input/output registers. The GSD file is imported into a PROFIBUS Master which in turn produces a file that is downloaded into the PLC or supervisory package. It works on the 'drag and drop' principle by clicking on parameters within lists (which correspond to the parameter lists in the controller) and dragging the chosen parameter to input or output windows.

INSTALLATION

The program will run on Windows 3.1, Windows 95 or Windows NT.

To install the program, place the Eurotherm PROFIBUS-DP Support Disc in your drive and run A:\SETUP.EXE from the program manager or Windows explorer.
Follow the on-screen prompts to install the configurator. These prompts will ask for:

- User and Company name.
- Set up will install Profconf in the directory C:\europrof. To install to a different directory, click browse and select another directory.
- Set up will add program icons to the program folder, but you may type a new folder name or select one from the existing folders list.
- Set up will then launch the program
- The screen layout shown below is the default screen supplied on the EURO2400.GSD file

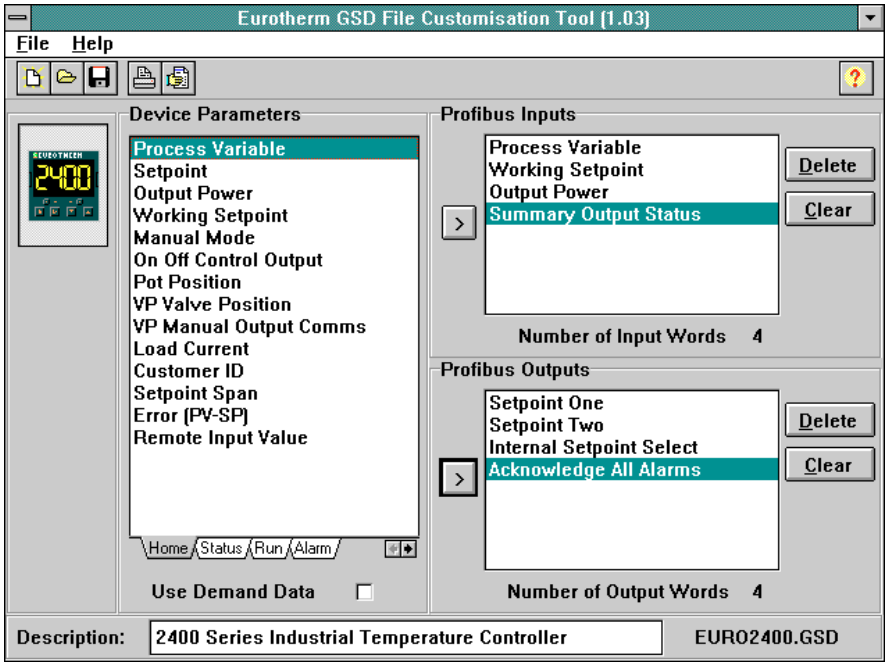


Figure 5-1: The Default Configurator Screen Layout.

Leave the mouse cursor over a portion of the screen to see a hint explaining how it works. Hints can be turned off via the Help menu once you have learned how to operate the program.

Open a GSD file for modification or editing, or create a new file for the currently selected controller type, using the 'file' menu. Note, however, that only files for the Eurotherm products, which include 2400*f* and T630, may be edited using this program.
Selected input or output parameters may be printed using the 'print' command in the 'file' menu.
Standard Windows facilities for Save and Save As are provided, allowing GSD files to be written to disk.
The buttons on the task bar provide quick access to most of these functions.

The controller parameter set is represented by a box to the left of the screen. A set of tabs allows a group of parameters to be displayed, corresponding to lists in the controller user interface. A separate list for 2400*f* series status words is also provided for the controller type.

To add a parameter to the PROFIBUS-DP Input Data, simply drag it from the Device Parameter list using the mouse, and drop it into the Inputs list. Similarly, drop a parameter into the Outputs list to set PROFIBUS-DP Output Data. Alternatively, double click on a parameter name to add it to the currently selected window - select the list by clicking on it - or use the arrow button to the left of the input and output lists. You may change the order of the Input and Output List by dragging and dropping between them. Parameters may be deleted or the list cleared using the buttons on the right hand side of the I/O lists, or by pressing the right mouse button when the cursor is over a parameter name, whereupon a pop up menu will be displayed.

Select or remove support for 'Demand Data' (see Chapter 7) using the check box in the lower part of the screen. Add a short description of the function of the GSD file in the lower window: this will usually be displayed by your network configuration tool when selecting a device from the list.

Once the I/O data has been specified to your wishes, save the GSD file to disk: you may use any filename you wish. You may then import it into your PROFIBUS-DP network configuration tool and use it in an application program. It is possible to save several different GSD files for the same basic instrument, thereby setting up a library for different applications.

Example:
GSD file to allow gain scheduling using a PID settings stored in a PLC

Input Data
- Process Variable

Output Data:
- Proportional Band
- Integral Time
- Derivative Time
- Cutback High
- Cutback Low

In this application, the PLC monitors 'Process Variable' (actual temperature), and when it passes into a particular pre-set band, sets the output data parameters from settings stored in the PLC.

Use the right mouse button when the cursor is over a parameter in the left hand window to determine its tag for demand data operations.

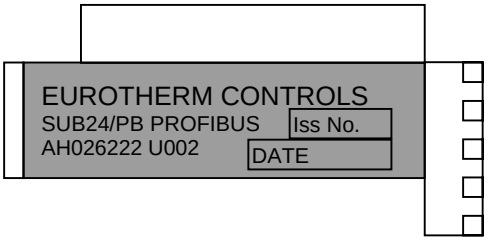
A limit of 117 **total** input and output words, including the requirements for demand data, is imposed by the configurator. When this limit is reached, it will no longer be possible to add parameters into either the input or output lists until other parameters have been deleted. In any case it is advisable not to exceed 32 input and 32 output words in total, since some masters are unable to deal with more.

To obtain a summary of the I/O memory map for the current GSD file, select 'View I/O map' from the file menu. This may be pasted into the clipboard and placed into a document if required for project documentation. It may also be printed directly from the File menu.

CHAPTER 6 TROUBLESHOOTING

No Communications:

- Check the wiring carefully, paying particular attention to the continuity of the A and B connections to the Master. Ensure that the correct terminals have been wired to.
- Access the HA list in configuration level and check that the function (Func) is set to PrOF. If not, the controller is not configured for PROFIBUS-DP.
- Check Node Address (Addr) in the Cms list is correct for the network configuration in use.
- Ensure that a PROFIBUS-DP Comms Module is installed in slot H of the 2404/8*f*. It can be identified by of the legend on the plug-in module casing, and its distinctive shape:



- Ensure that the network is correctly configured and the configuration has been transmitted correctly to the PROFIBUS-DP master.
- Verify the GSD file in use is correct by loading it into the GSD File Configuration. This will check the format.
- Verify that the maximum line length for the baud rate in use is not exceeded (see table above). Note that the 2404/8*f* is restricted to use at a maximum rate of 1.5 Mbaud.
- Ensure that the last device (not necessarily a 2404/8*f*) in the network segment is correctly terminated (see wiring diagram).
- Ensure that no devices other than those at the end of a network segment have termination networks fitted.
- If possible, replace suspect device with a duplicate and retest.

Intermittent Failure to Communicate.
Intermittent Flickering of Status From 'rdY' to 'run'.
Diagnostic Status Changing but no Alarms Present in the Controller.

- Verify wiring, paying particular attention to screening.
- The I/O data length may be too long. Some PROFIBUS-DP Master implementations can accept no more than 32 input and 32 output words per slave device. Verify by reference to documentation of the Master.
- Verify that the maximum line length for the baud rate in use is not exceeded (see cable specifications). Note that the 2404/8*f* is restricted to use at a maximum rate of 1.5 Mbaud.
- Ensure that the last device (not necessarily a 2404/8*f*) in the network segment is correctly terminated (see wiring diagram).
- Ensure that no devices other than those at the end of a network segment have termination resistors fitted.
- Verify operation with a duplicate device if possible.

Setpoint, Output Power, Auto/Manual etc 'jammed' to one setting and cannot be altered using controller front panel.

- PROFIBUS-DP writes all 'output' data continuously, so that if Output Power, Setpoint, or Auto/Manual status are included in the output data, their settings, as stored in the master data registers, will override any setting entered using the front panel of the controller. To avoid this, here are some suggestions for possible techniques.
- Use 'Demand Data' to write parameter values only when changes are required
- (Setpoints only) Use SP2 as a 'manual' setpoint, selectable locally using a digital input or key switch, and SP 1 as a 'PROFIBUS-DP remote'.
- Note that when the network fails and the instrument goes off-line to PROFIBUS-DP, the front panel will regain full control, so that the controller may be used as a local 'island' of control.

Data format or parameter data seems incorrect

- Verify that the data format is correctly configured ('FuLL', or 'I nt'), from the HA ConF list in the controller.

Verify that the GSD file is correct for the given application by loading it into the GSD file configurator program.

CHAPTER 7 DEMAND DATA

The GSD file is used to define those parameters which need to be updated continuously. It is, therefore, a convenient way to transfer input and output data between the controller and the master PLC or Supervisory Computer. It is, however, wasteful in comms bandwidth if, for example:

1. It is used to read or write to occasionally accessed data, such as autotune or a three term value
2. Complex read/writes are performed which require a lot of data exchange, such as setting up and running a programmer.

For these parameters use the 'Demand Data' sub-protocol. This allows read/write access to any parameter within the controller using, what are known as 'Tags' which identify the parameters. Each parameter has a unique 16 bit tag, a full list of which is given in the next chapter.

When Demand Data is used, the first four (16 bit) registers of the PROFIBUS-DP Output data are reserved to encode a ***'request message'*** using the protocol. The control program is responsible for writing values into the first four registers to make requests. The instrument uses the first four registers of PROFIBUS-DP input data as a ***'response message'*** to return values and indicate success or failure of the operation that was requested.

It is enabled by the PROFIBUS-DP master setting the first byte of the module configuration data to 73 hex. This is done automatically, when:

- Using the EURD2400.GSD GSD file.
- The check box (Use Demand Data) in the EURO2400.GSD configurator program is selected.

Demand Data is supported by standard software in many PLCs. It can be implemented easily as part of the PLC program.

Demand Data uses the first 8 bytes in both the request and response message of the cyclic Data Exchange.

DEMAND DATA STRUCTURE

Read Request (from PLC)

PLC Output Register Number	Output Data
The first four registers are reserved for demand data. The control program is responsible for writing values into these first four registers to make requests.	
1	Command Code and Parameter Tag
2	Extended Parameter Tag
3	Reserved
4	Anything
The registers that follow are used for the fixed output data defined by the GSD file	
5	Value or State
6	Value or State
7	Value or State
etc.	Value or State

Response to Read Request (from Controller)

PLC Input Register Number	Input Data
The first four registers are reserved for responses to demand data.	
1	Command Code and Parameter Tag
2	Extended Parameter Tag
3	Reserved
4	Returned value
The registers that follow are used for the fixed input data defined by the GSD file	
5	Value or State
6	Value or State
7	Value or State
etc.	Value or State

Write Request (from PLC)

PLC Output Register Number	Output Data
The first four registers are reserved for demand data. The control program is responsible for writing values into these first four registers to make requests.	
1	Command Code and Parameter Tag
2	Extended Parameter Tag
3	Reserved
4	Value or State to be written
The registers that follow are used for the fixed output data defined by the GSD file	
5	Value or State
6	Value or State
7	Value or State
etc.	Value or State

Response to Write Request (from Controller)

PLC Output Register Number	Output Data
The first four registers are reserved for responses to demand data.	
1	Command Code and Parameter Tag
2	Extended Parameter Tag
3	Reserved
4	Write error code
The registers that follow are used for the fixed output data defined by the GSD file	
5	Value or State
6	Value or State
7	Value or State
etc.	Value or State

THE COMMAND CODE AND TAG ARE ENCODED INTO REGISTER 1 AS FOLLOWS:

Bits 15-12	Bit 11	Bit 10 - 0
Command Code	Reserved	Parameter Tag

Because only 11 bits are available for the Parameter Tag, the maximum tag allowable for standard demand data operations is 2048. The 2400*f* series controller allows tag values of up to 16383, therefore, extended tags have been provided using register 2. This is particularly important if ramp/dwell programs or configuration information is to be transferred over PROFIBUS-DP.

Fields in a request (output registers) should be set as follows: ***NB: Eurotherm Extensions are printed in bold italic text***

Command (Hex)	Request (Master to Slave)	Parameter Tag	Extended Parameter Tag	Value
0000	No Command	-	-	-
1000	Read Request	Tag to Read	-	-
2000	Write Request	Tag to Write	-	Value to write
3000	***Extended Read Request***	***Must be Zero***	***Tag to Read***	***-***
4000	***Extended Write Request***	***Must be Zero***	***Tag to Write***	***Value to Write***

Valid responses to a given command are as follows:

Command Field in request (output register)	Command Field in response (input register)	Meaning	Returned Value (input register 4)
0000	0000	Acknowledge No Command	-
1000	1000	Tag Read Successfully	Value Read
1000	7000	Tag Read Not Successful	Error Code (see below)
2000	1000	Tag Written Successfully	-
2000	7000	Tag Write Not Successful	Write Request
3000	*1000*	*Extended Tag Read Successfully*	*Value Read*
3000	*7000*	*Extended Tag Read Not Successful*	*Error Code* (see below)
4000	*1000*	*Extended Tag Written Successfully*	-
4000	*7000*	*Extended Tag Write Not Successful*	*Error Code* (see below)

The command field in the response message either

- Confirms that no operation has been requested
- Indicates that a Read or Write request has been completed successfully
- Indicates that a Read or Write has failed.

Error Codes in input register 4 are as follows.

Error Code	Meaning
0	Invalid Tag Number
1	Read Only Parameter
2	Value out of range

Worked example 1 - Starting an Autotune

An autotune is a good example of an operation that might be performed using the demand data sub-protocol, since it is a relatively infrequent operation and it would be wasteful to dedicate PROFIBUS-DP I/O data to such a task.

Request 1: Clear any previous demand data requests. You should do this at the start of any sequence of operations using demand data in order to ensure that the system is properly initialised.

PLC Output Register Number	Output Data	Comment
1	0	
2	Anything	
3	Anything	
4	Anything	

Response 1: Wait until the following response message is received in the input data:

PLC Input Register Number	Input Data	Comment
1	0	
2	Anything	
3	Anything	
4	Anything	

Request 2: Write 1 to Autotune enable. Note Tag address is 270 (decimal) see 'TAG ADDRESSES' Chapter 8

PLC Output Register Number	Output Data	Comment
1	8462	Write request 2000 (hex) (8192 dec) + tag address 270 (dec.) = 8462 (dec)
2	Anything	
3	Anything	
4	1	Write state 1 to enable Autotune see enumerators for each tag address in Chapter 8

Response 2: Wait for one of the following responses to be received.
a. An error has occurred (Code 7)

PLC Input Register Number	Input Data	Comment
1	28942	Error 7000 (Hex) (28672 dec) + tag address (270 dec) = 28942
2	Anything	
3	Anything	
4	1 or 2 or 3	Invalid tag number Read only parameter Value out of range

b. No error

PLC Input Register Number	Input Data	Comment
1	4366	Successful write code 1000 (Hex) (4096dec) + tag address 270 (decimal) = 4366
2	Anything	
3	Anything	
4	Anything	

Request 3: If there was no error, poll Control Status Word (tag 76) until autotune complete.

PLC Output Register Number	Output Data	Comment
1	4172	Successful write code 1000 (Hex) (4096dec) + tag address 76 (decimal) = 4172
2	Anything	
3	Anything	
4	Anything	

To determine when Autotune is complete:
Look at the PROFIBUS-DP Input data until either bit 3 (Self Tune Fail) of the value field is set, or bit 12 (Autotune enabled) is cleared. There is no need to set up more requests, since the value field will be automatically updated by the slave, but you should not try to access other demand data until this operation has completed. Any value for register 1 other than 4172 signifies an error has occurred, in which case register 4 will contain an error code of 0 or 1 or 2.

PLC Input Register Number	Input Data	Comment
1	4172	
	Anything	
3	Anything	
4	XXXX	The value of the Control Status Word

Worked example 2 - Uploading Program Data

The 2400*f* series with PROFIBUS-DP may be configured with a ramp/dwell programmer option. It is often the case that specific ramp dwell sequences need to be downloaded to an instrument. Because of the amount of data involved, it would be impossible if only standard PROFIBUS-DP input and output frames were to be used. Use of the demand data protocol is the only way the operation may be performed.

Note that if the programmer option is configured, the instrument defines two types of program data store. Program 0 holds a copy of the currently running program (if any) which may be accessed or changed in 'hold' mode only. Programs 1, and 2, 3, and 4 for a 4 programmer instrument, hold the actual program data and may be accessed at any time.

From the tag list, we find that the Program 1 has tags running from 8328 to 8463. This is above the maximum of 2047 for a standard tag read, so we will need to use the Eurotherm extensions.

Note that a program download is essentially the inverse of this operation, using extended tag writes.
The sequence of operations to upload a ramp/dwell program is as follows:

Request 1: Clear any previous demand data requests. You should do this at the start of any sequence of operations using demand data in order to ensure that the system is properly initialised.

PLC Output Register Number	Output Data	Comment
1	0	
2	Anything	
3	Anything	
4	Anything	

Response 1 Wait until the following response message is received in the input data:

PLC Input Register Number	Input Data	Comment
1	0	
2	Anything	
3	Anything	
4	Anything	

Request 2: Read from the first program address.

PLC Output Register Number	Output Data	Comment
1	12288	Extended read tag 3000 (Hex)
2	8328	Program 1 tag address,. see Chapter 8
3	Anything	
4	Anything	

Response 2: Wait for one of the following responses to be received.

a. An error has occurred

PLC Input Register Number	Input Data	Comment
1	37000	Error 7000 (Hex) (28672 dec) + tag address 8328 (dec) = 37000
2	Anything	
3	Anything	
4	0 1 2	Invalid tag number Read only parameter Value out of range

b. No error.

PLC Input Register Number	Input Data	Comment
1	12288	Extended read tag 3000 (Hex)
2	8328	Program 1 tag address,. see Chapter 8
3	Anything	
4	Anything	

If there was no error, store the Program Value in the required memory location, increment register 2 in the request message, and repeat until tag 8463 (end of program 1 segments) has been reached.

Tags

Parameter Tags may be obtained by reference to the following chapter. Note also that the GSD Configuration Program allows the display of the tag for a given parameter, by clicking the right mouse button when pointing to the parameter.

CHAPTER 8 TAG ADDRESSES

Tag addresses are used to identify parameters in the controller and are identical to the Modbus addresses which are also listed in the Series 2000 Communications Manual, Eurotherm Part No. HA 026230. Tag addresses are used with the demand data protcol to set up input/output data in the PLC or supervisory PC.. They are repeated here in the order in which they appear in the GSD file.
They can also be read from the Windows Configurator by pointing to the parameter and clicking the right mouse button.

Controller Display	Home Tab Parameter Description	Tag Address
	Process Variable	1
SP	Target setpoint	2
OP	% Output power For ON/OFF controllers the following power levels must be written: Cool -100% OFF 0% Heat 100%	3
w.SP	Working set point. Read only: use Target set point or currently selected set point (1 to 16) to change the value	5
m-A	Auto-man select 0: Auto 1: Manual	273
	Pot Position	317
-	Valve Posn (computed by VP algorithm)	53
-	VP Manual Output (alterable in Man only)	60
AmPS	Heater current (With PDSIO mode 2)	80
Cid	Customer defined identification number	629
	Setpoint Span	552
	Error (PV-SP)	39
	Remote Input Value	26

Status Tab		Tag Address
Summary Output Status Word		75
BIT	**DESCRIPTION**	
0	Alarm 1 State (0 = Safe 1 = Alarm)	
1	Alarm 2 State (0 = Safe 1 = Alarm)	
2	Alarm 3 State (0 = Safe 1 = Alarm)	
3	Alarm 4 State (0 = Safe 1 = Alarm)	
4	Manual Mode (0 = Auto 1 = Manual)	
5	Sensor Break (0 = Good PV 1 = Sensor Broken)	
6	Loop Break (0 = Good closed loop 1 = Open Loop)	
7	Heater Fail (0 = No Fault 1 = Load fault detected)	
8	Tune Active (0 = Auto Tune disabled 1 = Auto Tune active)	
9	Ramp/Program Complete (0 = Running/Reset 1 = Complete)	
10	PV out of range (0 = PV within table range 1 = PV out of table range)	
11	DC control module fault (0= Good. 1= BAD)	
12	Programmer Segment Synchronise (0 = Waiting, 1 = Running)	
13	Remote input sensor break (0 = Good, 1 = Bad)	
14	IP1 Fault	
15	Reserved	

Status Tab		Tag Address
Fast Status Byte		74
BIT	**DESCRIPTION**	
Bit 0	Alarm 1 State (0 = Safe 1 = Alarm)	
Bit 1	Alarm 2 State (0 = Safe 1 = Alarm)	
Bit 2	Alarm 3 State (0 = Safe 1 = Alarm)	
Bit 3	Alarm 4 State (0 = Safe 1 = Alarm)	
Bit 4	Manual Mode (0 = Auto 1 = Manual)	
Bit 5	Sensor Break (0 = Good PV 1 = Sensor Broken)	
Bit 6	Loop Break (0 = Good closed loop 1 = Open Loop)	
Bit 7	Heater Fail (0 = No Fault 1 = Load fault detected)	
Control Status Word		76
BIT	**DESCRIPTION**	
0	Control algorithm Freeze	
1	PV input sensor broken	
2	PV out of sensor range	
3	Self Tune failed	
4	PID servo signal	
5	PID debump signal	
6	Fault detected in closed loop behaviour (loop break)	
7	Freezes the integral accumulator	
8	Indicates that a tune has completed successfully	
9	Direct/reverse acting control	
10	Algorithm Initialisation flag	
11	PID demand has been limited.	
12	Autotune enabled	
13	Adaptive tune enabled	
14	Automatic Droop compensation enabled	
15	Manual / Auto mode switch	
Instrument Status Word		77
BIT	**DESCRIPTION**	
0	Config/Oper mode switch	
1	Disables limit checking	
2	SRL ramp running (Read Only)	
3	Remote setpoint active	
4	Alarm acknowledge switch.	
5	Reserved	
6	Reserved	
7	Reserved	
8	Reserved	

9	Reserved
10	Reserved
11	Reserved
12	Reserved
13	Reserved
14	Reserved
15	Reserved

Program Logic Status	162

BIT	DESCRIPTION
0	Program Output 1 (0 = OFF 1 = ON)
1	Program Output 2 (0 = OFF 1 = ON)
2	Program Output 3 (0 = OFF 1 = ON)
3	Program Output 4 (0 = OFF 1 = ON)
4	Program Output 5 (0 = OFF 1 = ON)
5	Program Output 6 (0 = OFF 1 = ON)
6	Program Output 7 (0 = OFF 1 = ON)
7	Program Output 8 (0 = OFF 1 = ON)
8	Reserved
9	Reserved
10	Reserved
11	Reserved
12	Reserved
13	Reserved
14	Reserved
15	Reserved

Digital Output Status Word	551

BIT	DESCRIPTION
0	H Interface module telemetry (0 = Off, 1 = On)
1	J Interface module telemetry (0 = Off, 1 = On)
2	1A module telemetry (0 = Off, 1 = On)
3	LB logic telemetry (0 = Off, 1 = On)
4	LA logic telemetry (0 = Off, 1 = On)
5	1B module telemetry (0 = Off, 1 = On)
6	1C module telemetry (0 = Off, 1 = On)
7	2A module telemetry (0 = Off, 1 = On)
8	2B module telemetry (0 = Off, 1 = On)
9	2C module telemetry (0 = Off, 1 = On)
10	3A module telemetry (0 = Off, 1 = On)
11	3B module telemetry (0 = Off, 1 = On)
12	3C module telemetry (0 = Off, 1 = On)
13	AA relay telemetry (0 = Off, 1 = On)
14	Reserved
15	Reserved

Digital Input Status Word	87

BIT	DESCRIPTION
0	H Interface module (0 = Off, 1 = On)
1	J Interface module (0 = Off, 1 = On)
2	1A module (0 = Off, 1 = On)
3	LB logic input (0 = Off, 1 = On)
4	LA logic input (0 = Off, 1 = On)
5	1B module telemetry (0 = Off, 1 = On)
6	1C module (0 = Off, 1 = On)
7	2A module (0 = Off, 1 = On)
8	2B module (0 = Off, 1 = On)
9	2C module (0 = Off, 1 = On)
10	3A module (0 = Off, 1 = On)
11	3B module (0 = Off, 1 = On)
12	3C module (0 = Off, 1 = On)
13	Reserved
14	Reserved
15	Reserved

Parameter Description	Tag Address
SP Rate Limit Holdback Status 0: Inactive 1: Active	41
Pot Break	350
Freeze Control Flag 0: Controlling 1: Hold	257
SP Rate Limit Active Status 0: No setpoint rate limit 1: Setpoint rate limit active	275
Sensor Break Status Flag 0: Good 1: Sensor break	258
Power Failed flag 0: Good 1: Power fail detected	259
New Alarm Flag	260
Loop Break Status Flag 0: Good 1: Loop break	263
Integral Hold Status Flag 0: Good 1: Integral hold	264
SRL Complete Status 0: Setpoint rate limit incomplete 1: Setpoint rate limit complete	277
Remote Input Status Flag 0: Good 1: Fault	280
Sync Continue Flag 0: Continue 1: Awaiting synch	281

Controller Display	Run Tab Parameter Description	Tag Address
PrG	Current program running (active prog no.)	22
StAt	Program Status 1: Reset 2: Run 4: Hold 8: Holdback 16: Complete	23
PSP	Programmer setpoint	163
CYC	Program cycles remaining	59
SEG	Current segment number	56
StYP	Current segment type 0: End 1: Ramp (Rate) 2: Ramp (Time to target) 3: Dwell 4: Step 5: Call	29
SEGt	Segment time remaining in secs	36
	Segment time remaining in mins	63
tGt	Target setpoint (current segment)	160
rAtE	Ramp rate	161
PrGt	Program time remaining	58
FASt	Fast run 0: No 1: Yes	57
out.1	Logic 1 output (current program) 0: Off (applies to all 8 logic outputs) 1: On (applies to all 8 logic o/ps)	464
out.2	Logic 2 output (current program)	465
out.3	Logic 3 output (current program)	466
out.4	Logic 4 output (current program)	467
out.5	Logic 5 output (current program)	468
out.6	Logic 6 output (current program)	469
out.7	Logic 7 output (current program)	470
out.8	Logic 8 output (current program)	471
Sync	Segment synchronisation 0: No 1: Yes	488
SEG.d	Flash active segment in lower display	284
	Advance Segment Flag	149
	Skip Segment Flag	154
	Program Logic Status	162

Controller Display	Alarm Tab Parameter Description	Tag Address
1---	Alarm 1setpoint value	13
2---	Alarm 2setpoint value	14
3---	Alarm 3setpoint value	81
4---	Alarm 4setpoint value	82
HY1	Alarm 1 hysteresis	47
HY2	Alarm 2 hysteresis	68
HY3	Alarm 3 hysteresis	69
HY4	Alarm 4 hysteresis	71
Lbt	Loop break time 0: Off	83
di AG	Enable diagnostic messages 0: No Diagnostics 1: Diagnostics	282
	Acknowledge All Alarms	274

Controler Display	Autotune Tab Parameter Description	Tag Address
tunE	Autotune enable 0: No Tune 1: Tune	270
drA	Adaptive tune enable 0: No Adaotive Tune 1: Tune	271
drA.t	Adaptive tune trigger level	100
Adc	Automatic droop compensation (manual reset) 0: Manual reset 1: Calculated	272

Controller Display	PID Tab Parameter Description	Tag Address
G.SP	Gain scheduler setpoint	153
SEt	Current PID set (read only if gain scheduling is selected) 0: Set 1 1: Set 2	72
Pb	Proportional band PID1	6
ti	Integral time PID1 0: Off	8
td	Derivative time PID1 0: Off	9
rES	Manual reset PID1	28
Hcb	Cutback high PID1 0: Auto	18
Lcb	Cutback low PID1 0: Auto	17
rEL.c	Relative cool gain PID1	19
Pb2	Proportional band PID2	48
ti 2	Integral time PID2 0: Off	49
td2	Derivative time PID2 0: Off	51
rES.2	Manual reset PID2	50
Hcb2	Cutback high PID2 0: Auto	118
Lcb2	Cutback low PID2 0: Auto	117
rEL2	Relative cool gain PID2	52
FF.Pb	Feedforward proportional band	97
FF.tr	Feedforward trim	98
FF.du	Feedforward trim limit	99

Controller Display	Motor Tab Parameter Description	Tag Address
tm	Valve travel time	21
In.t	Valve inertia time	123
bAc.t	Valve backlash time	124
mP.t	Minimum pulse time	54
u.br	Bounded sensor break strategy	128
Sb.oP	VP Bounded sensor break	62

Controller Display	Setpoint Tab Parameter Description	Tag Address
SSEL	Select setpoint 0: SP1 1: SP2	15
	2: SP 3 3: SP 4 4: SP 5 5: SP 6 6: SP 7 7: SP 8 8: SP 9 9: SP 10 10: SP 11 11: SP 12 12: SP13 13: SP14 14: SP15 15: SP16	
L-r	Local or remote setpoint select 0: Local 1: Remote	276
SP 1	Setpoint 1	24
SP 2	Setpoint 2	25
SP 3	Setpoint 3	164
SP 4	Setpoint 4	165
SP 5	Setpoint 5	166
SP 6	Setpoint 6	167
SP 7	Setpoint 7	168
SP 8	Setpoint 8	169
SP 9	Setpoint 9	170
SP 10	Setpoint 10	171
SP 11	Setpoint 11	172
SP 12	Setpoint 12	173
SP 13	Setpoint 13	174
SP 14	Setpoint 14	175
SP 15	Setpoint 15	176
SP 16	Setpoint 16	177
rm.SP	Remote setpoint	485
rmt.t	Remote setpoint trim	486
rAt	Ratio setpoint	61
Loc.t	Local setpoint trim	27
SP L	Setpoint 1 low limit	112
SP H	Setpoint 1 high limit	111
SP2.L	Setpoint 2 low limit	114
SP2.H	Setpoint 2 high limit	113
Loc.L	Local setpoint trim low limit	67
Loc.H	Local setpoint trim high limit	66
SPrr	Setpoint rate limit 0: Off	35
Hb.tY	Holdback type for sp rate limit 0: Off 1: Low 2: High 3: Band	70
Hb	Holdback value for srtpoint rate limit	65
	Dwell Segment	62
	Goto	517
	Programmer State Write	57
	Programmer state Read	23

Controller Display	Input Tab Parameter Description	Tag Address
FiLt	Input 1 filter time constant 0: Off	101
FLt.2	Input 2 filter time constant 0: Off	103
PUiP	Select input 1 or input 2	288
F.1	Derived input function factor 1	292
F.2	Derived input function factor 2	293
Hi.IP	Switchover transition region high	286
Lo.IP	Switchover transition region low	287
	Potentiometer Calibration Enable	310
	Potentiometer Input Calibration Node	311
	Potentiometer Calibration Go	312
Emi5	Emmisivity	38
Emi5.2	Emmisivity input 2	104
CAL	User calibration enable 0: Factory 1: User	110
CAL.S	Selected calibration point 0: None 1: Input 1 low 2: Input 1 high 3: Input 2 low 4: Input 2 high	102
AdJ	User calibration adjust input 1	146
AdJ	User calibration adjust input 2	148
OFS.1	Input 1 calibration offset	141
OFS.2	Input 2 calibration offset	142
mU.1	Input 1 measured value	202
mU.2	Input 2 measured value	208
CJC.1	Input 1 cold junction temp. reading	215
CJC.2	Input 2 cold junction temp. reading	216
Li.1	Input 1 linearised value	289
Li.2	Input 2 linearised value	290
PUSL	Currently selected setpoint	291

Controller Display	Output Tab Parameter Description	Tag Address
OP.Lo	Low power limit	31
OP.Hi	High power limit	30
rOP.L	Remote low power limit	33
rOP.H	Remote high power limit	32
OPrr	Output rate limit 0: Off	37
FOP	Forced output level	84
CYC.H	Heat cycle time	10
hYS.H	Heat hysteresis (on/off output)	86
ont.H	Heat output minimum on time 0: Auto	45
CYC.C	Cool cycle time	20
hYS.C	Cool hysteresis (on/off output)	88
ont.C	Cool output minimum on time 0: Auto	89
HC.db	Heat/cool deadband (on/off op)	16
End.P	Power in end segment	64
Sb.OP	Sensor break output power	34
Sb.OP	On/Off Sensor Break Output Power 0: -100% 1: 0% 2: 100%	40

Controller Display	Information Tab Parameter Description	Tag Address
di SP	Configuration of lower readout display 0: Standard 1: Load current 2: Output power 3: Status 4: Program time 5: None 6: Valve position 7: Process value 2 8: Ratio setpoint 9: Selected program number 10: Remote setpoint	106
LoG.L	PV minimum	134
LoG.H	PV maximum	133
LoG.A	PV mean value	135
LoG.t	Time PV above threshold level	139
LoG.u	PV threshold for timer log	138
rES.L	Logging reset 0: Not reset 1: Reset	140
mCt	Maximum Control Task Time (Processor utilisation factor)	201
w.OP	Working output	4
SSr	PDSIO SSR status 0: Good 1: Load fail 2: Open 3: Heater fail 4: SSR fail 5: Sn fail	79
FF.OP	Feedforward component of output	209
P OP	Proportional component of output	214
I OP	Integral component of output	55
d OP	Derivative component of output	116
uP S	VP motor calibration state 0: Start 1: Waiting 2: Open valve 3: BLUp/InDn 4: Ttup 5: Overshoot 6: InUp/BLDn 7: TT down 8: Open 9: Low lim 10: Stopping 11: Raise 12: Inert up 13: Lower 14: Low lim 15: Stopping 16: Lower 17: InDn/BL 99: Abort	210

Controller Display	I/O Tab Parameter Description	Tag Address
	DC Output 1A Telemetry	12694
	DC Output 2A Telemetry	12758
	DC Output 3A Telemetry	12822
	BCD Input Value	96

Controller Display	Miscellaneous Tab Parameter Description	Tag Address
	Instrument Mode	199
	Instrument Version Number	107
	Instrument Ident	122
	Slave Instrument Target Setpoint	92
	Slave Instrument Ramp Rate	93
	Slave Instrument Sync	94
	Remote SRL Hold	95
	CNOMO Manufacturers ID	121
	Remote Parameter	151
	Error Logged Flag	73
	Ramp Rate Disable	78
	Maximum Input Value	548
	Minimum Input Value	549
	Holdback Disable	278
	All User Interface Keys Disable	279

Controller Display	Instrument Configuration Tab Parameter Description	Tag Address
CtrL	Control type 0: PID 1: On/Off 2: Manual 3: VP (No feedback) 4: VP b (Feedback)	512
Act	Control action 0: Reverse 1: Direct	7
CooL	Type of cooling 0: Linear 1: Oil 2: Water 3: Fan 5: On/Off	524
ti.td	Integral and Derivative time units 0: Seconds 1: Minutes 2: Hours	529
dtYP	Derivative action on: 0: PV 1: Error	550
m-A	Front panel Auto/Manual button 0: Enabled 1: Disabled	530
r-h	Front panel Run/Hold button 0: Enabled 1: Disabled	564
PwrF	Power feedback enable 0: Off 1: On	565
Fwd.t	Feed forward type 0: None 1: Power feedforward 2: Setpoint feedforward 3: PV feedforward	532
Pd.tr	Manual/Auto transfer PD control 0: No 1: Yes	555
Sbr.t	Sensor break output 0: Sensor break (go to set value) 1: Hold (output)	553
FOP	Forced manual output 0: No 1: Trac (returns to last value) 2: Step (steps to forced output level)	556
bcd	BCD input function 0: None 1: Select program number 2: Select SP number	522
GSch	Gain schedule enable 0: No (disabled) 1: Yes (enabled)	567

Controller Display	Custom Linearisation Tab Parameter Description	Tag Address
in 1	Custom linearisation input 1	601
VAL.1	Display value corresponding to input 1	621
in 2	Custom linearisation input 2	602
VAL.2	Display value corresponding to input 2	622
in 3	Custom linearisation input 3	603
VAL.3	Display value corresponding to input 3	623
in 4	Custom linearisation input 4	604
VAL.4	Display value corresponding to input 4	624
in 5	Custom linearisation input 5	605
VAL.5	Display value corresponding to input 5	625
in 6	Custom linearisation input 6	606
VAL.6	Display value corresponding to input 6	626
in 7	Custom linearisation input 7	607
VAL.7	Display value corresponding to input 7	627
in 8	Custom linearisation input 8	608
VAL.8	Display value corresponding to input 8	628

Controller Display	Process Value Configuration Parameter Description	Tag Address
unit	Instrument units 0: °C 1: °F 2: °K 3: None	516
dEc.P	Decimal places in displayed value 0: nnnn 1: nnn.n 2: nn.nn	525
rnG.L	Setpoint Min. (Low range limit)	11
rnG.H	Setpoint Max. (High range limit)	12

Controller Display	Input Configuration Parameter Description	Tag Address
inPt	Input type 0: J Type 1: K Type 2: L Type 3: R Type 4: B Type 5: N Type 6: T Type 7: S Type 8: PL 2 9: Custom (factory) ***** 10: RTD ***** 11: Linear mV (+/- 100mV) 12: Linear V (0-10V) 13: Linear mA 14: Square root V 15: Square root mA 16: Custom mV 17: Custom V 18: Custom mA	12290
CJC	Cold junction compensation 0: Auto 1: 0°C 2: 45°C 3: 50°C 4: Off	12291
Imp	Sensor break impedance 0: Off (disabled linear. inputs only) 1: Auto 2: Hi (> 5K) 3: Hi Hi (>15K)	12301
inPL	Input value low	12307
inPh	Input value high	12306
UALL	Displayed reading low	12303
UALH	Displayed reading high	12302

Controller Display	Setpoint Configuration Parameter Description	Tag Address
nSP	Number of setpoints	521
rmtr	Remote tracking 0: Off 1: Track	526
mtr	Manual tracking 0: Off 1: Track	527
Prtr	Programmer tracking 0: Off 1: Track	528
rmPU	Setpoint rate limit units 0: /Sec 1: /Min 2: /Hour	531
rmt	Remote setpoint configuration 0: None 1: Remote setpoint 2: Remote setpoint + local trim 4: Remote trim + local setpoint	535

Controller Display	Alarm Configuration Parameter Description	Tag Address
AL 1	Alarm 1 type 0: Off 1: Full scale low 2: Full scale high 16: Deviation band 17: Deviation high 18: Deviation low 34: Load current low 35: Load current high 36: Input 2 full scale low 37: Input 2 full scale high 38: Working output low 39: Working output high 40: Working setpoint low 41: Working setpoint high	536
Ltch	Latching 0: No 1: Yes 2: Event 3: Manual reset	540
bLoc	Blocking 0: No 1: Yes	544
AL 2	Alarm 2 type (types as alarm 1)	537
Ltch	Latching (types as alarm 1)	541
bLoc	Blocking (types as alarm 1)	545
AL 3	Alarm 3 type (types as alarm 1)	538
Ltch	Latching (types as alarm 1)	542
bLoc	Blocking (types as alarm 1)	546
AL 4	Alarm 4 type (types as alarm 1) plus 64: Rate of change	539
Ltch	Latching (types as alarm 1)	543
bLoc	Blocking (types as alarm 1)	547

Controller Display	Programmer Configuration Parameter Description	Tag Address
PtYP	Programmer type 0: None 1: Single program 4: Four programs	517
HbAc	Holdback 0: Applies to whole program 1: Applies to each segment	559
Pwr.F	Power fail recovery 0: Ramp back 1: Reset 2: Continue	518
Srvo	Servo 0: Servo to PV 1: Servo to SP	520
out	Programmable event outputs Version 1 controllers: 0: None 3: Three 6: Six 8: Eight Versions 2 and 3 controllers: 0: None 1: Eight	558
SYNC	Synchronisation of programs 0: No 1: Yes	557
	Maximum Number Of Segments	211

LA Display	Digital Input 1 Configuration Tab Parameter Description	Tag Address
id	Identity 4: Logic	12352
Func	Input functions 192: None 193: Manual mode select 194: Remote setpoint select 195: Setpoint 2 select 196: PID set 2 select 197: Integral hold 198: One-shot self tune enable 199: Adaptive tune enable 200: Acknowledge alarms 201: Select full access level 202: Keylock 203: Up button 204: Down button 205: Scroll button 206: Page button 207: Run 208: Hold 209: Run/Hold 210: Reset 211: Skip 212: Holdback enabled 213: Least significant BCD digit 214: 2nd digit 215: 3rd digit 216: 4th digit 217: 5th digit 218: Most significant digit 219: Setpoint rate limit enable 220: Prog. waits at end of segment 223: Run/Hold 224: Reset/Run 225: Standby 226: PV select 227: Advance to end of segment 240: Amps	12355

LB Display	Digital Input 2 Configuration Tab Parameter Description	Tag Address
id	Identity: 4: Logic	12416
Func	Input functions, as LA above	12419
UAL.L	Low scalar	12431
UAL.H	High scalar	12430

AA Display	Alarm Relay Configuration Tab	Tag Address
	Parameter Description	
id	Module identity	12480
Func	Module function 0: None 1: Digital 2: Heat (2208/04 only) 3: Cool (2208/04 only)	12483
SEnS	Sense of output 0: Normal 1: Inverted	12489
	Summary of AA configuration	12486
	Program summary OP AA configuration	12503

HA Display	Comms Module 1 Configuration Tab	Tag Address
	Parameter Description	
rES	Comms Resolution 0: Full 1: Integer	12550

JA Display	Comms Module 2 Configuration Tab	Tag Address
	Parameter Description	
id	Module Identity 0: None 8: PDSIO output 9: PDSIO input	12608
VALL	Retransmitted Low Scalar	12623
VALH	Retransmitted High Scalar	12622
Func	Module Function For id = PdS 128: None 129: PDSIO SP retransmission 130: PDSIO PV retransmission 131: PDSIO OP retransmission 133: PDSIO SP retrans. no holdback For id = PdSi 96: None 97: PDSIO setpoint input	

1A Display	Output 1A Configuration Tab	Tag Address
	Parameter Description	
id	Module identity 0: None 1: Relay output 2: DC output non-isolated 3: Logic/PDSIO output 4: Logic input 5: Triac output 10: Error/Bad module 11: DC retransmission 12: DC output isolated	12672
Func	Module function For id = rELY LoG or SSr	12675
	0: None 1: Digital output 2: Heating output 3: Cooling output 4: Open motorised valve 10: PDSIO mode 1 heating 11: PDSIO mode 2 heating For id = dc.rE or dc.OP 16: None 17: Heating output 18: Cooling output 19: Retransmission of PV 20: Retransmission of SP 21: Retransmission of error 22: Retransmission of OP power For id = LoGi Use the enumerators in LA Config. list	
VALL	% PID or Retran value giving min. o/p	12687
VALH	% PID or Retran value giving max. o/p	12686
unit	Units 1: Volts 2: mA	12684
OutL	Minimum electrical output	12689
OutH	Maximum electrical output	12688
SEnS	Sense of output 0: Normal 1: Inverted	12681
	Summary output 1A configuration	12678
	DC output 1A telemetry parameter	12694
	Program summary output 1A config	12695

1B Display	Output 1B Configuration Tab	Tag Address
	Parameter Description	
id	Module 1B identity	12673
Func	Module 1B function	12676
SEnS	Sense of output (nor/inv as1A)	12682
	Summary of 1B configuration	12679
	Summary program O/P 1B config.	12696

1C Display	Output 1C Configuration Tab	Tag Address
	Parameter Description	
id	Module 1C identity	12674
Func	Module 1C function	12677
VALL	Module 1C value giving min output	12699
VALH	Module 1C value giving max output	12698
OutL	Module 1C Minimum electrical output	12701
OutH	Module 1C Maximum electrical output	12700
SEnS	Sense of output (nor/inv as 1A)	12683
	Summary of 1C configuration	12680
	Summary program O/P 1C config.	12697

2A Display	Output 2A Configuration Tab Parameter Description	Tag Address
id	Module identity 0: None 1: Relay output 2: DC output non-isolated 3: Logic/PDSIO output 4: Logic input 5: Triac output 10: Error/Bad module 11: DC retransmission 12: DC output isolated 13: Transmitter power supply 14: Pot input (valve position)	12736
Func	Module function For id = rELY LoG or SSr 0: None 1: Digital output 2: Heating output 3: Cooling output 5: Close motorised valve For id = dc.rE or dc.OP 16: None 17: Heating output 18: Cooling output 19: Retransmission of PV 20: Retransmission of SP 21: Retransmission of error 22: Retransmission of OP power For id = Pot 160: None 161: Remote setpoint 162: Feedforward input 163: Remote OP power high 164: Remote OP power low 165: Valve position	12739
UAL.L	% PID or Retran low value	12751
UAL.L	Potentiometer input low scalar	12763
UAL.H	% PID or Retran high value	12750
UAL.H	Potentiometer input high scalar	12762
unit	Units 1: Volts 2: mA	12748
OuE.L	Minimum electrical output	12753
OuE.H	Maximum electrical output	12752
SEnS	Sense of output 0: Normal 1: Inverted	12745
	Summary output 2A configuration	12742
	Program summary output 2A conf.	12759

2B Display	Output 2B Configuration Tab Parameter Description	Tag Address
id	Module 2B identity	12737
Func	Module 2B function	12740
SEnS	Sense of output (nor/inv as 2A)	12746
	Summary of 2B configuration	12743
	Summary program O/P 2B config.	12760

2C Display	Output 2C Configuration Tab Parameter Description	Tag Address
id	Module 2C identity	12738
Func	Module 2C function	12741
SEnS	Sense of output (nor/inv as 2A)	12747
	Summary of 2C configuration	12744
	Summary program O/P 2C config.	12761

3A Display	Output 3A Configuration Tab	Tag Address
	Parameter Description	
id	Module identity 0: None 1: Relay output 2: DC output non-isolated 3: Logic/PDSIO output 4: Logic input 5: Triac output 6: DC input 10: Error/Bad module 11: DC retransmission 12: DC output isolated 13: Transmitter power supply 14: Pot input (valve position)	12800
Func	Module function For id = rELY LoG or SSr 0: None 1: Digital output 2: Heating output 3: Cooling output For id = dc.rE or dc.OP 16: None 17: Heating output 18: Cooling output 19: Retransmission of PV 20: Retransmission of SP 21: Retransmission of error 22: Retransmission of OP power For id = Pot 160: None 161: Remote setpoint 162: Feedforward input 163: Remote OP power high 164: Remote OP power low 165: Valve position For id = dC.P 32: None 33: Remote setpoint 34: Feedforward input 35: Remote output power max. 36: Remote output power min. 37: PV = highest of ip1 or ip2 38: PV = lowest of ip1 or ip2 39: Derived function 40: Select ip1 or ip2 41: Transition of control - ip1-ip2	12803
inPt	input type (input 2) Refer to input configuration for all types + Hi In	12830
CJC	Cold junction compensation (ip 2) Refer to input config. for types	12831
imP	Sensor break impedance (input 2) Refer to input config. for types	12813
inP.L	Input value low	12819
inP.H	Input value high	12818
UAL.L	Input module 3A low value	12829
UAL.H	Input module 3A high value	12828
UAL.L	Module 3A low value	12815
UAL.L	Potentiometer input 3A low scalar	12827
UAL.H	Module 3A high value	12814
UAL.H	Potentiometer input 3A high scalar	12826
unit	Units 3A 1: Volts 2: mA	12812
OuT.L	Minimum electrical output	12817
OuT.H	Maximum electrical output	12816
SEnS	Sense of output 0: Normal 1: Inverted	12809
	Summary output 3A configuration	12806
	Program summary output 3A config	12823

3B Display	Output 3B Configuration Tab	Tag Address
	Parameter Description	
id	Module 3B identity	12801
Func	Module 3B function	12804
SEnS	Sense of output (nor/inv as 3A)	12810
	Summary of 3B configuration	12807
	Summary program O/P 3B config.	12824

3C Display	Output 3C Configuration Tab	Tag Address
	Parameter Description	
id	Module 3C identity	12802
Func	Module 3C function	12805
SEnS	Sense of output (nor/inv as 3A)	12811
	Summary of 3C configuration	12808
	Summary program O/P 3C config.	12825

4A Display	Output 4A Configuration Tab	Tag Address
	Parameter description	
id	Module identity 0: None 1: Relay output	12864
Func	Module function 0: None 1: Digital output 2: Heating output 3: Cooling output	12867
UAL.L	Input module 4A low value	12879
UAL.H	Input module 4A high value	12878
OuT.L	Minimum electrical output	12881
OuT.H	Maximum electrical output	12880
SEnS	Sense of output (nor/inv as 3A)	12873
	Summary output 4A configuration	12870
	Program summary output 4A config	12887

Pass Display	Password Configuration Tab	Tag Address
	Parameter Description	
ACCP	Access Mode Password	514
cnFP	Configuration Level Password	515

Ramp/Dwell Programmer Data

Program Data Organisation

A 2400*f* series controller can contain multiple "programs", each consisting of up to 16 segments. The data for each program starts at the base tag address given by the following table:

Program	Base Address (Decimal)	Base Address (Hex)
Program 0 (Currently Running Program - changes permitted only in hold, and are not permanently stored)	8192	2000
Program 1	8328	2088
Program 2	8464	2110
Program 3	8600	2198
Program 4	8736	2220

The parameters used to describe a program are organised into 17 blocks, each of 8 words in length, starting at the base address for the program. There is one block for general program data, such as the units to be used for ramp and dwell times, and 16 further blocks for the segment data itself. To obtain the tag address of the data block for a given program, add the block offset given in the next table to the program

Contents	Offset (Decimal)	Offset (Hex)
Program General Data	0	0
Segment 1	8	8
Segment 2	16	10
Segment 3	24	18
Segment 4	32	20
Segment 5	40	28
Segment 6	48	30
Segment 7	56	38
Segment 8	64	40
Segment 9	72	48
Segment 10	80	50
Segment 11	88	58
Segment 12	96	60
Segment 13	104	68
Segment 14	112	70
Segment 15	120	78
Segment 16	128	80

Program General Data

The offsets of each parameter within the program general data block is given by the next table:

Address Offset	Parameter
0	HoldbackType 0: None 1: Low 2: High 3: Band
1	HoldbackValue
2	Ramp Units 0: Secs 1: Mins 2: Hours
3	Dwell Units 0: Secs 1: Mins 2: Hours
4	Program Cycles
5	Reserved
6	Reserved
7	Reserved

Program Segment Data

Program segment data is specified using 8 tag addresses, with the contents varying depending on the type of the segment. The format per segment is detailed in the following table, which gives the offset from the start of a segment data block for each item.

Address Offset	Segment Types					
	STEP	DWELL	RAMP RATE	RAMP TIME TO TARGET	CALL	END
0	Segment Type	Segment Type	Segment Type	Segment Type	Segment Type	Segment Type
1	Target Setpoint		Target Setpoint	Target Setpoint		
2		Duration	Rate	Duration		
3					Program Number	End Type
4	Logic O/P's	Logic O/P's	Logic O/P's	Logic O/P's	Call Cycles	Logic O/P's
5						
6						
7						

Example Address calculations

Program 1, Segment 4, Segment Type = 8328 + 32 + 0 = 8360 (20A8 Hex)
Program 2, Holdback Value = 8464 + 0 + 1 = 8465 (2111 Hex)
Program 4 Segment 16, End Type = 8872 + 128 + 3 = 9003 (232B Hex)

Power Level in End Segment

This has the tag address 64 in 2400*f* controllers.

Summary of Programmer Enumerators

Controller Display	Parameter Description
tYPE	Current Segment Type 0: End 1: Ramp (Rate) 2: Ramp (Time to target) 3: Dwell 4: Step 5: Call
End.t	End Segment Type 0: Reset 1: Indefinate Dwell 2: Set Output

Controller Display	Parameter Description
Hb	Holdback Type 0: None 1: Low 2: High 3: Band
dwL.U	Dwell Units 0: Seconds 1: Minutes 2: Hours
rmP.U	Ramp Units 0: Seconds 1: Minutes 2: Hours

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.
DP	Decentralised Periphery (Distributed Control)
DPM1 DP Master (class 1)	The DPM1 is the central programmable controller for PROFIBUS-DP
DPM2 DP Master (class 2)	The DPM2 is a configuration device for PROFIBUS-DP
EIA	Electrical Industries Association, the standards body that has defined electrical requirements of communications systems such as RS232, RS422 and 485.
FMS	Fieldbus Message Specification. FMS defines the applications services for PROFIBUS-FMS
GSD	Device Data Base File. Electronic device data sheet.
MSB	Most significant byte
LSB	Least significant byte
Non synchronous	A data channel in which no timing information is transferred between communicating devices.
PA	Process Automation. PA is the PROFIBUS solution for the process automation industry.
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 '1's 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.
RS422	This refers to the electrical standard used for signalling information on a serial communications link.
RX	Receiver on a communication bus.
Tag Address	An address used to identify a parameter in an instrument
TX	Transmitter on a communication bus

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