

USER GUIDE
UGD027-0804



Communication Protocols for Common Controls - DC-2

Modbus Communications, Devicenet Gateway Communications and SPI Communications

Please record your equipment's model and serial number(s) and the date you received it in the spaces provided.

It's a good idea to record the model and serial number(s) of your equipment and the date you received it in the User Guide. Our service department uses this information, along with the manual number, to provide help for the specific equipment you installed.

Please keep this User Guide and all manuals, engineering prints and parts lists together for documentation of your equipment.

Date: _____

Manual Number: UGD027-0804

Serial Number(s):

Model Number(s):

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Common Controls Communication Options

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I. Modbus Communications

1. Description – The common controls series of products from Conair use standard Modbus communications protocol to allow a user to access the control boards for supervisory type functions. For example, a user may want to display the drying temperature for all hoppers in a facility at one central location. By connecting all the dryers to a central computer, the temperatures and setpoints could be displayed in one location using a standard SCADA software program such as Wonderware or RSVIEW.

Depending on the particular common controls board, the Modbus communication interface may be either RS-232 (DC2 display boards) or RS-485 (DC Control boards). If needed, converters may be ordered with the product to convert from one to the other. The RS-485 standard allows multiple controllers to be daisy-chained together over longer distances while RS-232 allows direct connection to most personal computers without an interface adapter.

2. Hardware Installation – The hardware required for Modbus communications is included with the product as shipped. Connectors and cabling must be supplied by the user or ordered from Conair. If your common controls product does not use the communication standard you desire (RS-232 vs RS-485) a converter is available. See the drawings in Appendix B for the proper cabling and connection information for both types of interface.
3. Parameter list – The Modbus interface uses standard Modbus protocol to communicate with a common controls system. The data that may be retrieved is arranged in a parameter list. By using the Modbus register read and write commands, the desired data may be read from or written to the controller. The list of data that may be set or retrieved with the common controls system is arranged in Modbus registers 500 to 539. See appendix A for the data contained in this area for your particular type of device (dryer, resinworks, etc.)

CAUTION: The list of data that may be read and written to by the user is arranged in a specific location (parameters 500 to 540). Writing to a location with improper data, or writing to an incorrect location may cause your common controls system to become inoperative or to operate in a manner that may damage your process. Be certain that you understand each parameter and its effect before changing anything.

II. Devicenet Gateway Communications

Description – The Conair Common Control board set allows the user to add Devicenet communications for information interchange with PLC systems or higher level

supervisory computer systems. The Devicenet communication is accomplished with a gateway device that converts the Modbus communications resident on the DC2 display board or the DC control board to Devicenet communications. The gateway is typically installed inside the control cabinet but may also be purchased with a DIN rail mounted enclosure. It is available with RS-232 (for the DC-2) or RS-485 (DC control) communications capability. These instructions assume the user is familiar with basic Devicenet configuration and use. If not, please refer to manuals from your Devicenet provider before attempting to use this gateway.

1. Hardware Installation and Configuration

- A. Installation** – The Devicenet Gateway is designed to mount on three standoffs which are attached to the door of the control cabinet below the main control board. Note that the gateway circuit board has two holes to mount the gateway and the board just rests on the third standoff to help stabilize the board. Cable 188629-04 connects between the gateway’s three pin connector and the control board, connector J4. The devicenet drop cable is then run to the five pin connector on the gateway.
- B. DIP Switch settings** – The gateway has two groups of DIP switches for configuration. the first set of switches (labeled S1 on the circuit board or next to the “address” label on the enclosure) is used to configure the address of the gateway on the Devicenet network and the baud rate used by the gateway for Devicenet communications. The second set of switches (labeled S2 on the circuit board or next to the “number of controllers label) is used to set the number of controllers attached to the gateway (useful only for RS-485 communications), to set the baud rate used to communicate between the gateway and the dryer, and to set the number of words of data transferred from the gateway to the devicenet scanner (10 or 20 words of data). The dipswitches are defined as follows:

Dipswitch S1

Position	function
8	Devicenet baud rate
7	Devicenet baud rate
6	Devicenet address
5	Devicenet address
4	Devicenet address
3	Devicenet address
2	Devicenet address
1	Devicenet address

Dipswitch S2

Position	function
8	Number of controllers (RS-485 only)
7	Number of controllers (RS-485 only)
6	Number of controllers (RS-485 only)
5	Number of controllers (RS-485 only)
4	Modbus baud rate
3	Reserved
2	Number of parameters to retrieve
1	Number of parameters to retrieve

(add/use drawings of dipswitches from specification)

C. LED Status Indicators

There are two LEDs on the gateway which give the status of the communications. The first LED, which is located between the dipswitches (labeled “Controllers” on gateways with the enclosure), gives the status of the Modbus communications between the gateway and the control circuit board. The second LED (labeled “Devicenet” on gateways with the enclosure) gives the status of the Devicenet communications.

1. Controller Status LED (between dipswitches)

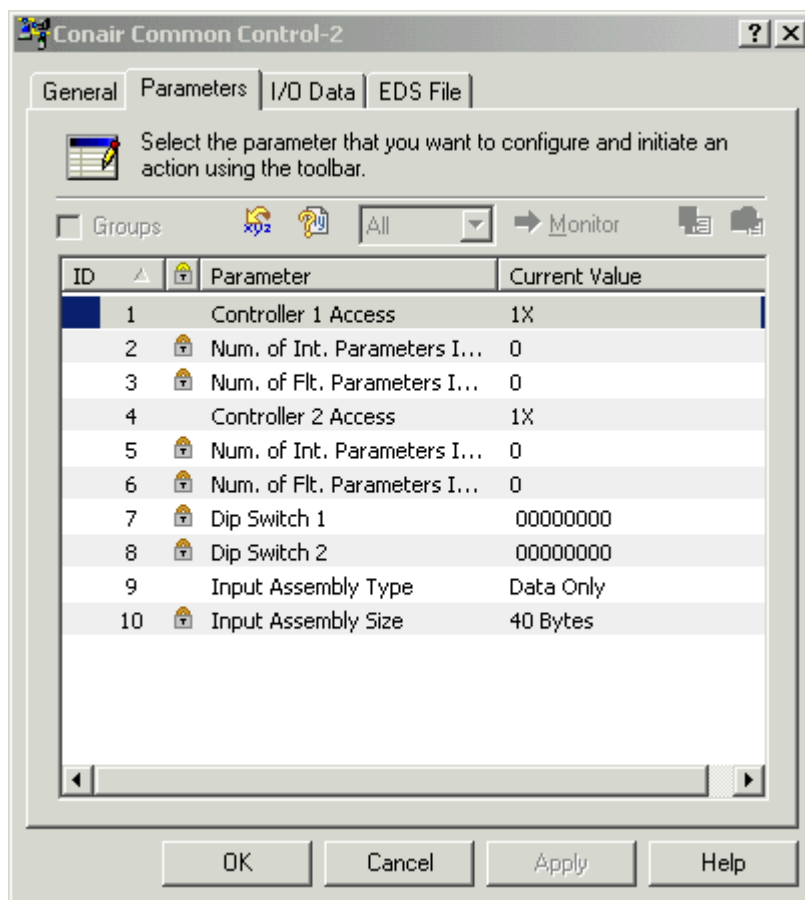
Color	State	Indication
None	Off	No power
Red	Solid	No controllers online
Red	Flashing	“Illegal Data” error
Green	Solid	Normal operation – All controllers online
Green	Flashing	One or more controllers offline or not present

2. Devicenet Status LED

Color	State	Indication
None	Off	No power
Red	Solid	Unrecoverable Devicenet fault
Red	Flashing	Output error or configuration error
Green	Solid	Normal operation
Green	Flashing	Device is in idle mode or not allocated to a master

3. Software Configuration

- A. Installation of EDS files – There are multiple EDS files associated with the gateway depending on how many controllers are attached to a gateway. The files are named based on the number of controllers i.e. an EDS file for a gateway with three controllers attached is named 3Conair.EDS. Choose the appropriate file for your application and install it using your Devicenet network’s EDS installer options. Once the EDS files are installed they will be shown under the “Conair Common Control” heading in the EDS file manager. If you install more than one of the EDS files the files will all be named “Conair Common Control” with a hexadecimal designator to differentiate the different files. By opening the device’s parameter list you can tell how many controllers are associated with the EDS file.



- B. EDS file parameter list Configuration options – Once the EDS file has been installed the gateway may be added to a network configuration. There are a number of parameters that may be configured for each gateway to optimize it for your application. The number of parameters will vary depending on how many controllers are attached to a gateway, but the type of parameters are as follows:

Parameter 1 Controller Access 1X, 10X, 100X

This parameter controls how the data that is retrieved from the controller will be formatted. If 1X is chosen the data will be retrieved as a whole number with no implied decimal place. For example, if a process temperature was retrieved and the real value of the temperature was 225.3927, the temperature would be read as 225 using the 1X register format. If 10X was chosen the raw data would be retrieved as 2253, requiring the user to add the implied decimal point to show the temperature as 225.3. Similarly if the data was retrieved in the 100X format the raw data would be 22539 requiring the user to add the decimal place to display it as 225.39.

Parameter 2 Number of Int. Parameters 0 to 40

This field will display how many integer parameters are retrieved from the controller. This will be either 10 or 20 depending on the position of dipswitch 2, switches 1 and 2.

Parameter 3 Number of Flt Parameters 0 to 10

This field will display how many floating point parameters are retrieved from the controller. The default is zero and is not normally changed by the user. If your application requires the use of floating point numbers, please consult with Conair Engineering.

Parameter 4 Dip Switch 1 Combination of 1's and 0's

This field shows the actual positions of dipswitch 1 on the gateway.

Parameter 5 Dip Switch 2 Combination of 1's and 0's

This field shows the actual positions of dipswitch 2 on the gateway.

Parameter 6 Input Assembly Type Status only, Status w/data, Data only

This field will choose whether the data retrieved consists of only the process data from the controller (data only), the status bytes from the gateway (status only), or the data and the status bytes (status w/data). Note that if this field is modified the change must

be applied. The size of the data block being retrieved (see parameter 7) will change based on the configuration of this parameter.

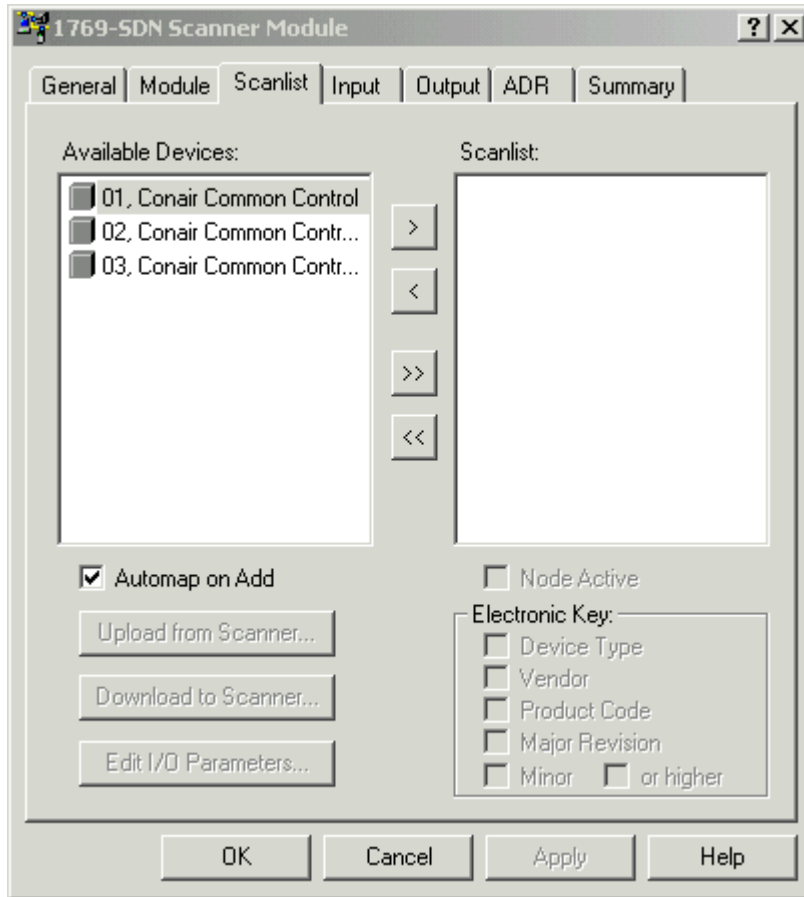
Parameter 7 Input Assembly Size 0 to 160

This field will display the actual size of the input data that is being retrieved from the gateway to the master on the Devicenet network. See the section on adding the gateway to the scan list for further information on this parameter.

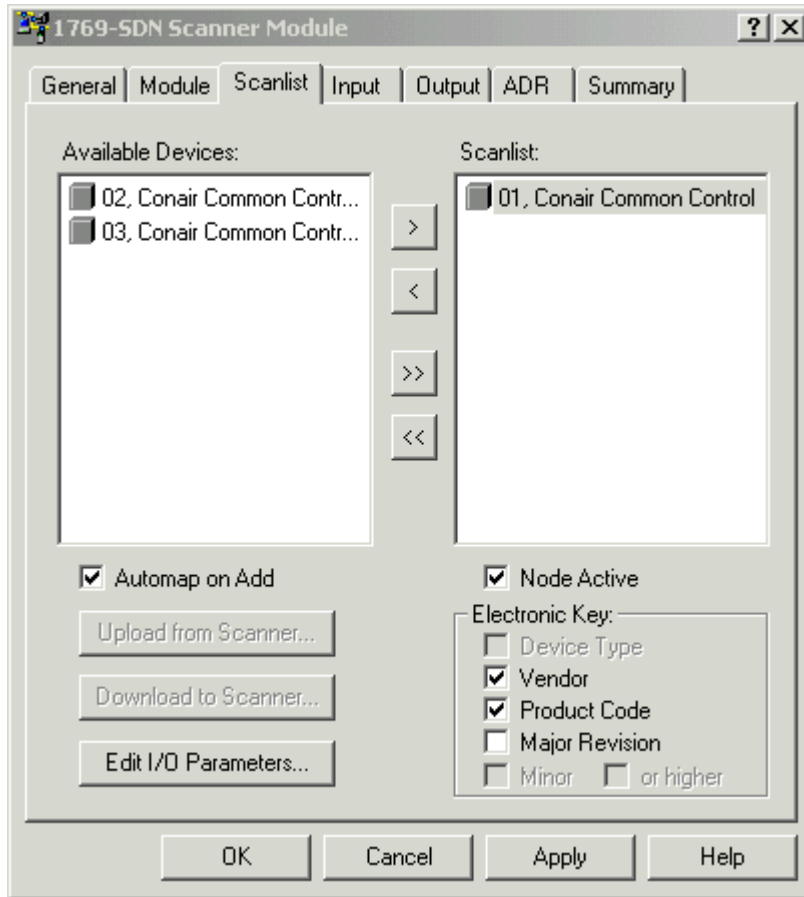
- C. Adding the gateway to the scan list – Adding the gateway to a scan list requires care to be certain that the data area is sized correctly and mapped to the correct locations. An example will be given using Rockwell Software’s RSNetworkx software for clarity’s sake.

Set all dipswitches per the previous sections. Go Online with the device on the network and set the parameters described above. After the parameters are set, download the parameters to the gateway using the “apply” button. After you have applied the parameters close the parameter list and reopen. Check Parameter 7 to see how many bytes of data are in the input assembly size.

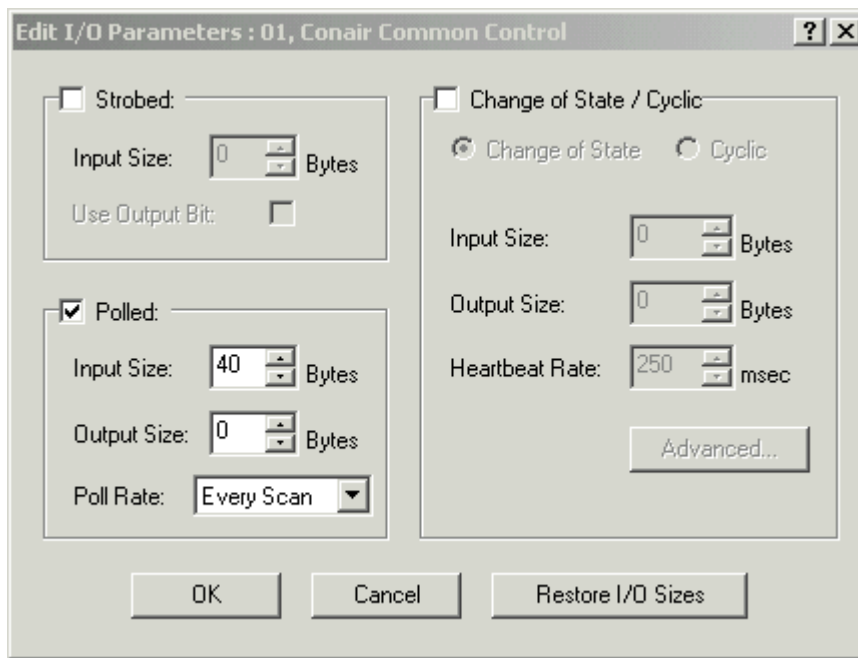
Go online with the scanner. Move the gateway from the “Available Devices” area to the Scanlist using the arrow key.



After the gateway has been moved, the “Edit I/O Parameters” pushbutton should be accessible.



Press this button to configure the I/O parameters.



The input size field should be modified to match the number of bytes shown in Parameter 7. Click OK to finish configuring the I/O parameters. Since the actual data size being used differs from the maximum possible data size, you will get an error message noting this. Click OK to keep the data size you have entered.

Once the I/O parameters have been modified, the gateway may be mapped to your desired I/O area using the Input tab. Depending on whether your controller is 16 bit (Allen Bradley Micrologix) or 32 bit (Allen Bradley Controllogix) the data may transfer either as individual words (16 bit) or two parameter words may be combined into a DINT (32 bit). All the parameters should now be accessible from the programmable logic controller (PLC).

D. Explicitly Writing to the Gateway.

As discussed above, the information from the Common Controls Systems can be set up to be read directly as inputs in a PLC system. In order to write data to the gateway however, the data must be written in a Devicenet Explicit message. This method was chosen to ensure that data is written once, only when the PLC decides it should be written. This reduces bandwidth on the network and ensures that the data is sent only when it is required. Please see your Devicenet system providers information on using explicit messaging for more details. Note that parameters 530 to 539 are set up as the registers to write to the common controls devices.

- E. Gateway Parameter list – Similarly to the Modbus communications, the Common Controls parameters that are available are stored in registers 500 to 539. The dipswitches determine how much of the list is transferred to the PLC. If the dipswitch is set for ten words, Modbus parameters 500 to 509 will be transferred to the input image of the scanner. If the dipswitches are set for twenty words, Modbus parameters 500 to 519 will be transferred to the scanner. See appendix A for the actual parameters that are available from the type of common control device that your system is attached to.

III. SPI Communications

Description

The Society of Plastics Industry (SPI) has defined a standard protocol to be used for interconnecting plastics equipment. This protocol uses the RS-485 standard as the physical connection and defines standard addresses and commands to communicate with the various kinds of equipment in common use at a typical plastics facility. For example, a dryer is specified as Device ID 22 hex, a chiller is Device ID 21 hex. The data retrieved for each type of equipment is defined in the standard. For a dryer or other piece of equipment to be in compliance with the SPI standard you must be able retrieve certain parameters such as the Setpoint Process Temperature, High and Low Temperature deviation alarms, Temperature to the process, Temperature from the process, etc.. Some parameters are also designated as optional parameters that may or may not be available dependent on the equipment providers discretion.

Hardware installation

The SPI option is available with the DC2 operator display boards. These display boards have an RS-232 port built into the board. An RS-232 to RS-485 converter is provided which mounts on the inside of the door of the electrical cabinet. The RS-485 SPI signal is then brought to the outside of the cabinet via a 9 pin D-sub connector. Refer to Conair drawing 130024 and 188629 in appendix B for details of the installation. The RS-485 SPI signal is available on pins 4 and 5 of the DB-9 connector. Pins 8 and 9 also have the RS-485 connection (paralleled with pins 4 and 5) to assist in Daisy chaining equipment together.

Software configuration

The SPI protocol option must be turned on and configured in the operator display before it may be used. To set up the SPI communications, first enter the supervisors password level (password 0210). See the equipment's manual if you are unsure of how to do this. Once you are in the supervisors password level, go to the setup/Other/Com menu. Scrolling down through the menu set the "Protocol" to SPI, set the slave ID to a unique address on the RS-485 network, and set the baud rate to the same speed as the RS-485 network master. Once the entries are complete, return to the opening menu and cycle power on the equipment to establish the new settings.

In order to connect Conair equipment to a host computer system, Conair can provide an SPI-DDE server which will allow DDE compliant software packages such as Wonderware or Excel to connect to the SPI network with minimal programming required.

For more information on the SPI protocol, you can obtain the SPI Communication protocol manual by contacting:

The Society of Plastics Industry, Inc.
1801 K Street, NW, Suite 600K
Washington, D.C. 20006
(202) 974-5200 Fax (202) 296-7005
www.plasticsindustry.org

Supported Dryer SPI Commands

SPI protocol defines two different modes, select and poll. “Select” commands are used to set or change the information in the dryer. For example to change a temperature setpoint from 200 to 225 deg f. “Poll” commands are used to read the information without changing or modifying it. For example when you simply want to display the actual process temperature. In either case two hex command bytes are sent to the equipment to specify what communication action to take. The following list shows the select and poll bytes along with a description of the information that may be retrieved from Conair dryers.

1. Echo – Allows the master to test a piece of equipment by writing 4 bytes of information to the equipment and then reading it back.

Select: 20h, 21h Poll: 20h, 20h

2. Version – Read the SPI version from the equipment

Select: NA Poll: 20h, 22h

3. Setpoint Process Temperature – Sets and retrieves the process temperature setpoint.

Select: 20h, 31h Poll: 20h, 30h

4. Alarm, High Temperature Deviation – Sets and retrieves the high temperature deviation alarm setpoint. Note that in Conair dryers there is actually only one deviation setpoint that is used for both high and low temperature deviation. The last value written to either the high or the low will be the value that is used.

Select: 20h, 33h Poll: 20h, 32h

5. Alarm, Low Temperature Deviation – Sets and retrieves the low temperature deviation alarm setpoint. Note that in Conair dryers there is actually only one deviation setpoint that is used for both high and low temperature deviation. The last value written to either the high or the low will be the value that is used.

Select: 20h, 35h Poll: 20h, 34h

6. Status, Process – This word shows the status of the process with each bit showing a particular condition. The bits are defined as follows:

- Bit 0 Processing (dryer running)
- Bit 1 Alarm, System (any alarm that indicates a problem that may affect the drying operation)
- Bit 2 Alarm, Process (any alarm that indicates a problem with the process itself)
- Bit 3 Alarm, Machine (any alarm that indicates a problem with the dryer itself)
- Bit 4 Alarm, High Temperature Deviation
- Bit 5 Alarm, Low Temperature Deviation
- Bit 6 Reserved
- Bit 7 Reserved
- Bit 8 Alarm, filter clogged
- Bit 9 Alarm, Low flow
- Bit 10 Alarm, High Dewpoint
- Bit 11 Reserved
- Bit 12 Reserved
- Bit 13 Reserved
- Bit 14 Temperature out of band deviation
- Bit 15 Not used

Select: NA

Poll: 20h, 40h

7. Status, Machine 1 – This word shows the status of the Dryer itself with each bit showing a particular condition. The bits are defined as follows:

- Bit 0 Processing (dryer running)
- Bit 1 Alarm, System (any alarm that indicates a problem that may affect the drying operation)
- Bit 2 Alarm, Process (any alarm that indicates a problem with the process itself)
- Bit 3 Alarm, Machine (any alarm that indicates a problem with the dryer itself)
- Bit 4 Alarm, High Temperature (any temperature input)
- Bit 5 Alarm, Low Temperature (any temperature input)
- Bit 6 Reserved
- Bit 7 Reserved
- Bit 8 Reserved
- Bit 9 Alarm, Low flow
- Bit 10 Alarm, High Voltage (not supported)
- Bit 11 Alarm, Low Voltage (not supported)
- Bit 12 Alarm, High Current (not supported)
- Bit 13 Alarm, Low Current (not supported)
- Bit 14 Alarm, Phase
- Bit 15 Not used

Select: NA

Poll: 20h, 42h

8. Status, Machine 2 – This word shows the status of the Dryer itself with each bit showing a particular condition. The bits are defined as follows:
- Bit 0 Processing (dryer running)
 - Bit 1 Alarm, System (any alarm that indicates a problem that may affect the drying operation)
 - Bit 2 Alarm, Process (any alarm that indicates a problem with the process itself)
 - Bit 3 Alarm, Machine (any alarm that indicates a problem with the dryer itself)
 - Bit 4 Fault, Sensor
 - Bit 5 Fault, Calibration
 - Bit 6 Reserved
 - Bit 7 Reserved
 - Bit 8 Reserved
 - Bit 9 Reserved
 - Bit 10 Reserved
 - Bit 11 Reserved
 - Bit 12 Reserved
 - Bit 13 Reserved
 - Bit 14 Not used
 - Bit 15 Not used

Select: NA Poll: 20h, 44h

9. Mode, Machine – This word is used to start/stop the dryer, acknowledge alarms and observe the run status.

- Bit 0 Start/Stop (1=running or start, 0= stop or stopped)
- Bit 1 Acknowledge Alarms

Select: 20h, 49h Poll: 20h, 48h

10. Temperature, To Process – This is the actual process (drying) temperature controlled by the dryer

Select: NA Poll: 20h, 70h

11. Temperature, From Process – This is the actual temperature as read by the RTD at the exit of the drying hopper. This is the temperature that is used for setback control in the dryer. Note that this is an optional feature and the value may be invalid if the feature is not installed on the dryer.

Select:NA Poll: 20h, 72h

12. Flow, To Process – This is the flow of dry air to the process. Not that this is an optional feature and the value may be invalid if the feature is not installed on the dryer.

Select:NA

Poll: 20h, 78h

13. Dewpoint – This is the actual dewpoint of the process air. Note that this is an optional feature and the value may be invalid if the feature is not installed on the dryer.

Select: NA

Poll: 20h, 7Ch

14. Setpoint, High Dewpoint Alarm – This is the setpoint for the dewpoint alarm triggered by item 13.

Select: 20h, 81h

Poll: 20h, 80h

Appendix A – Modbus Parameters

DC2 Control

Read Area

Modbus Register Number	Description	Comments
500	Product Type	
501	Process Temperature Setpoint	
502	Process Actual Temperature	
503	Process Temperature Setpoint (Setback)	
504	Return Air Temperature Out of Hopper	
505	Return Air Setpoint (Setback)	
506	Regeneration Actual Temperature	
507	Dewpoint Actual	
508	Operational Mode	
509	Running Status	
510	Return Air Actual	
511	Shutdown Alarms	
512	Passive Alarms	
513	Load Rate Setpoint (Setback)	
514	Average load Rate Actual (Setback)	
515	Process Heater Output Actual %	
516	Regen Heater Output Actual %	
517	Process Protect Actual Temperature	
518	Product Type	
519	Product Type	

Write Area

Modbus Register Number	Description	Comments
530	Process Temperature Setpoint	
531	Process Temperature Setpoint (Setback)	
532	Return Air Setpoint (Setback)	
533	Load Rate Setpoint (Setback)	
534	PM1 Dewpoint Setpoint	
535	Start Command	1 = start
536	Stop Command	1 = stop
537	Alarm Acknowledge	
538	Process Temperature Setpoint	
539	Process Temperature Setpoint	

Appendix B – Related Drawings

130023

130024

188629

We're Here to Help


Conair has made the largest investment in customer support in the plastics industry. Our service experts are available to help with any problem you might have installing and operating your equipment. Your Conair sales representative also can help analyze the nature of your problem, assuring that it did not result from misapplication or improper use.

Additional manuals and prints for your Conair equipment may be ordered through the Customer Service or Parts Department for a nominal fee. Most manuals can be downloaded free of charge from the product section of the Conair website.
www.conairgroup.com

How to Contact Customer Service

To contact Customer Service personnel, call:



 **NOTE:** Normal operating hours are 8:00 am - 5:00 pm (EST). After hours emergency service is available at the same phone number.

From outside the United States, call: 814-437-6861

You can commission Conair service personnel to provide on-site service by contacting the Customer Service Department. Standard rates include an on-site hourly rate, with a one-day minimum plus expenses.

Before You Call...

If you do have a problem, please complete the following checklist before calling Conair:

- Make sure you have all model, control type from the serial tag, and parts list numbers for your particular equipment. Service personnel will need this information to assist you.
- Make sure power is supplied to the equipment.
- Make sure that all connectors and wires within and between control systems and related components have been installed correctly.
- Check the troubleshooting guide of this manual for a solution.
- Thoroughly examine the instruction manual(s) for associated equipment, especially controls. Each manual may have its own troubleshooting guide to help you.
- Check that the equipment has been operated as described in this manual.
- Check accompanying schematic drawings for information on special considerations.

Equipment Guarantee

Conair guarantees the machinery and equipment on this order, for a period as defined in the quotation from date of shipment, against defects in material and workmanship under the normal use and service for which it was recommended (except for parts that are typically replaced after normal usage, such as filters, liner plates, etc.). Conair's guarantee is limited to replacing, at our option, the part or parts determined by us to be defective after examination. The customer assumes the cost of transportation of the part or parts to and from the factory.

Performance Warranty

Conair warrants that this equipment will perform at or above the ratings stated in specific quotations covering the equipment or as detailed in engineering specifications, provided the equipment is applied, installed, operated and maintained in the recommended manner as outlined in our quotation or specifications.

Should performance not meet warranted levels, Conair at its discretion will exercise one of the following options:

- Inspect the equipment and perform alterations or adjustments to satisfy performance claims. (Charges for such inspections and corrections will be waived unless failure to meet warranty is due to misapplication, improper installation, poor maintenance practices or improper operation.)
- Replace the original equipment with other Conair equipment that will meet original performance claims at no extra cost to the customer.
- Refund the invoiced cost to the customer. Credit is subject to prior notice by the customer at which time a Return Goods Authorization Number (RGA) will be issued by Conair's Service Department. Returned equipment must be well crated and in proper operating condition, including all parts. Returns must be prepaid.

Purchaser must notify Conair in writing of any claim and provide a customer receipt and other evidence that a claim is being made.

Warranty Limitations

Except for the Equipment Guarantee and Performance Warranty stated above, Conair disclaims all other warranties with respect to the equipment, express or implied, arising by operation of law, course of dealing, usage of trade or otherwise, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.