-METASYS®

Digital Control Module 140

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Introduction

Description

The Digital Control Module 140 (DCM140) is a point interface and control module residing in the Network Control Unit (NCU) or Network Expansion Unit (NEU). It functions as a co-processor for the NCM, providing Proportional-Integral-Derivative (PID) algorithms to regulate modulating devices. By use of dual-input and dual-output function modules, the DCM140 may be equipped with up to 20 universal (analog/binary) inputs and a range of 10-20 analog/binary outputs, depending on the function module mix. Light Emitting Diodes (LEDs) on the module face indicate the operational status for the input and output channels.

The DCM140 serves as a plug-in replacement for the DCM101.

Theory of Operation

The Digital Control Module's inputs, outputs, and firmware enable it to perform closed-loop control over the devices wired to it. Yet, it receives all its system configuration data (e.g., analog input sensor type, universal output FM type) from the NCM (Item **1** of Figure 1) via the N2 Bus **(2)**.

Before operation, the N2 Bus End-of-Line switch **(3)** and the DCM140 address switches **(4)** must be set to establish the hardware location on the system.

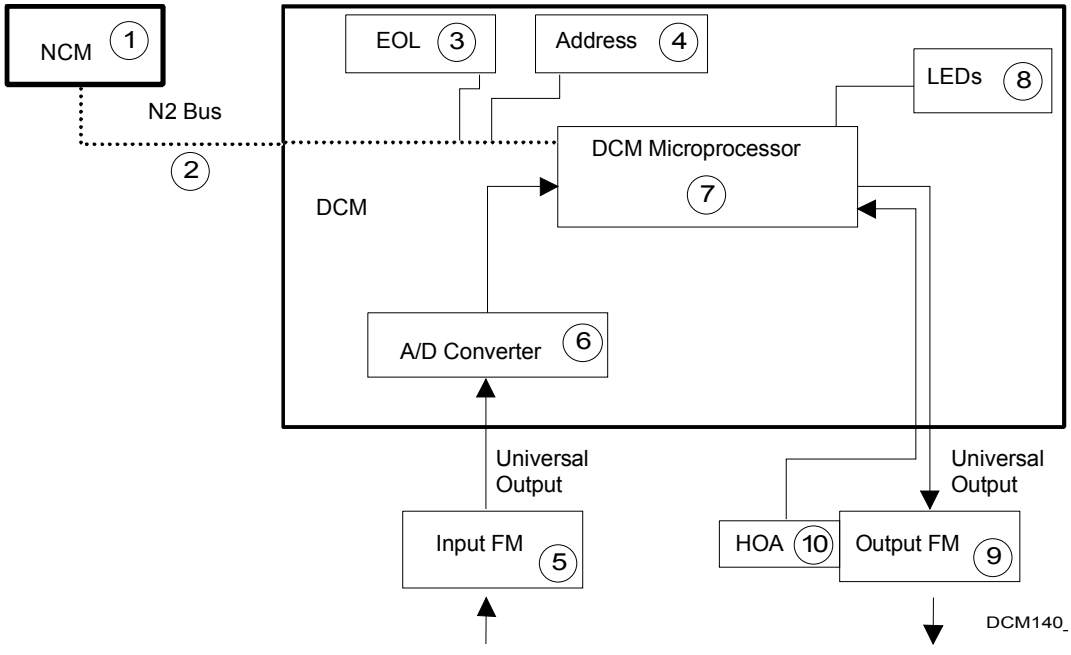


Figure 1: Block Diagram of DCM140 Operation

Input Function Modules **(5)** condition field signals from up to 20 separate devices, and relay them to the DCM140 in one of the following modes (options are selected by FM jumpers and software):

Table 1: Voltage and Current Modes

Mode	Description
Voltage	0 to 10 Volts (Note: Valid readings begin at 3 mV. See *Devices That Report Zero Volts*, under *Engineering*, for information on how to read zero as a valid condition.)
Current	0 to 20 mA power sourcing and sensing are performed over the same two wires. Sensing of remotely sourced current is optional. A software option also allows a user to span from 4 to 20 mA.
1000 ohm RTD	Implements a 4-wire or 2-wire approach accepting 1000 ohm. Resistance Temperature Device (RTD) signals. (This mode also senses a single dry contact state.)
100 ohm RTD	Implements a 4-wire approach accepting 100 ohm RTD signals.

For the voltage and current modes, the input has 12 bit resolution. The DCM140 compensates for circuit drift as a result of ambient temperature changes. Individual RTD input resolutions are detailed under *Specifications*.

The data is then processed through an Analog/Digital converter **(6)**.

The DCM140's microprocessor **(7)** performs independently of the NCM, executing control algorithms to determine commands for those devices under its control.

Twenty closed-loop outputs are available in software, any of which can be used in a master/submaster control loop.

The command issued to an output function module is based either on the DCM140's internal control action, or by order of the NCM. Parameters to determine the sensitivity and speed of the adjustments are user set. Below are some of the capabilities provided by the DCM140's microprocessor:

Proportional-Integral-Derivative (PID) Algorithms

The *proportional* algorithm controls a device based on the *present* performance. It calculates the difference between the set point and feedback and adjusts the actuating device to close the gap. Both direct and reverse action commands may be carried out.

The *integral* portion of the algorithm controls the device based on *past* performance. The difference between the set point and feedback is integrated (accumulated) over time, and if the proportional algorithm is insufficient to reach the setpoint in a timely manner, the integral algorithm contributes to the response.

Future performance is adjusted using the *derivative* part of the algorithm. The feedback's current rate of change (the derivative) predicts the future value of the feedback. As the controller sees the feedback changing faster, the derivative term provides a braking function to avoid overshooting the setpoint.

PID Diagnostics sample PID inputs and outputs to display a 60-count circular buffer for up to 4 of the 30 PID attributes.

Point Status Change Reports

This feature notifies an operator of Changes-of-State (COS), and provides automatic responses. The DCM140 latches and holds any valid data changed from a point; further data changes are ignored until the first-detected change has been reported to, and acknowledged from, the NCM.

Debounce Filter

To reduce reports from noisy contacts, the debounce filter ignores transient or intermittent changes by requiring consecutive identical inputs before determining a change in state.

Self-Tuning

Self-tuning is a software program that automatically and continually modifies (fine tunes) PID loop parameters to maintain a correct feedback value. Besides simplifying control loop startups, self-tuning adjusts control strategy due to mechanical aging of devices, or shifting variables, such as varying temperatures. Two user-set parameters define acceptable error and govern the authority of self-tuning (ranging from disabled to fully enabled).

Bumpless Transfer

When software control transfers from manual to automatic mode, bumpless transfer activates as a means to prevent mechanical system upset or potential damage. This routine tracks the commands sent prior to transfer in relation to the difference between the setpoint and feedback of the device. It then resolves the differences to reach setpoint. Softstart, a related algorithm, brings chillers and fan systems under normal control from startup, without setpoint hunting.

The LED board on the front of the module **(8)** indicates the status of the following:

Table 2: LED Board

LED	Description
Power	Lit when all supply voltages are at their specified operating levels.
Error	Lit during any sanity reset of the microprocessor. Note: Indicates a reset only. Continuous resets indicate an error. Refer to the *Troubleshooting Procedures* section for more information on LED errors.
N2 Transmit	Flickers when the DCM140 transmits on the N2 Bus.
N2 Receive	Flickers when the DCM140 detects any receive data on the N2 Bus.
Inputs	Status of inputs (Binary = user-defined; Analog = signal is within defined warnings/limits).
Outputs	Status of outputs (Binary = user-defined: Analog = the LED is always Off).

The ten universal outputs **(9)** transmit both binary and analog commands to their respective function modules. Each of the outputs can be equipped with dual-output analog function modules to control twenty separate devices.

Additionally, the universal outputs interrogate their function modules' Hand/Off/Auto (HOA) switch **(10)**.

Engineering

Design Considerations

When configured for use with either the Input Analog (IAN) or Output Analog (OAN) function modules, the DCM140 requires Metasys® Release 5.02 or above.

The general DCM140 engineering steps are to:

1. Define the DCM140 hardware to the system software. (For information about defining inputs and outputs, refer to the *Operator Workstation User's Manual FAN-634*).
2. Define the PID loops to the system software (refer to the *PID Loop (PIDL) Technical Bulletin*).
3. Select and install the appropriate function modules, then wire the field devices to the terminal blocks. Refer to the individual function module documents for information and requirements specific to that FM.

LEDs

Input LEDs

Binary: LEDs indicate the "present state" as defined by the user (either contact open or contact closed).

Analog: Input LEDs light when the operational status is normal (reliable). For the dual-input IAN function module, both channels must be reliable for the LED to light.

Output LEDs

Binary: LEDs indicate the "present state" as defined by the user (either contact open or contact closed).

Analog: LEDs remain Off.

Replacing the DCM101

The repair NU-DCM140-700 can serve as a plug-in replacement for the DCM101-0. No definition changes are needed.

When supervised by an NCM101, the DCM140 must be configured as a DCM101, and it cannot support either the IAN or OAN.

Inputs

Function modules interface inputs from devices that transmit voltage and current, or sense RTD (1000 ohm, 100 ohm), frequency, and pressure signals. The DCM140 has the capacity for ten input function modules. Most FMs support a single input device. The Input Analog (IAN) and Input Binary (IBN) function modules support two independent inputs.

Depending on the mix of input FMs, the DCM140 supports up to twenty inputs. Below is a table of the input function modules, along with the kind of signals they connect to the DCM140.

Table 3: Input Function Modules

Module	Description
FM-IUN102-0	Input Universal: Directly transmits voltage, current, and RTD signals into the DCM140 after conveying the signals through sense circuitry, contact debounce circuitry, and protective circuitry.
FM-IAN101-0*	Input Analog: Simultaneously interfaces two independent inputs of the same type. Accepts 2-Wire 1000 ohm RTD or 0-10 VDC. (VDC signals must be externally sourced.)
FM-IBN101-0	Input Binary: Simultaneously interfaces two independent inputs. Dry Contact or 120 VDC/VAC.
FM-IBF101-0	Input Binary Frequency: Senses data as either a rapidly cycling contact closure (up to 32 kHz) or input voltage (0-30 VRMS).
FM-IAP101-0	Input Analog Pneumatic: A Pressure/Electric Transducer, reading from 0 - 25 psi.
FM-IDPxxx-0 **FM-IDPBxxx-0**	Input Differential Pressure: Interfaces fourteen ranges of differential pressure for use by the DCM140.

- To use an FM-IAN101-0, the DCM140 must communicate to an NCM200 (or later), which contains Release 5.02 (or later) software.

The 1000 ohm RTD input configuration accepts these temperature sensors:

- 1000 ohm platinum (DIN0.00385 Standard.):--Input temperature range is -66.46 to 140.43°C (-87.62 to 284.77°F).
- Johnson Controls nickel:--Input temperature range is -34.4 to 110°C (-30 to 230°F).
- Johnson Controls silicon (TE6100-961):--Input temperature range is -19.71 to 79.63°C (3.47 to175.33°F).

When using a 1000 ohm RTD, a 2-wire connection is recommended for cable runs up to 150 feet. The 2-wire connection can also be made for longer runs, with wire length compensation added in software. Alternatively, the 4-wire option (FM-IUN102 only) compensates for any cable length.

The 100 ohm RTD input configuration accepts a 100 ohm Platinum (DIN0.00385 Standard.) temperature sensor: Input temperature range is -30 to 230°F. All 100 ohm applications require a 4-wire connection (FM-IUN102 only).

Input wiring to the DCM140 does not require shielding in general. For extremely long runs without conduit, or where high EMI/RFI conditions are expected, shielding is a good precaution. If an existing installation has shielded cable, be sure to install and terminate the shields as detailed in the function module technical bulletins.

IAN Input Timing Considerations

The Input Analog FM (IAN), enables you to connect two separate devices of the same signal type (i.e., both voltage or both RTD) to the DCM140 via a single FM slot. When implementing this dual-input FM, the DCM140's scan rate of those inputs will change from its typical once per second scan to once every six seconds. To ensure that all fast control loops are properly handled, assign all high-priority inputs to single input FMs.

This change in scan rates is independent of the mix of FMs: the DCM140 reads an IAN input at once per six seconds (and all other input FMs at once per second).

Devices That Report Zero Volts

The DCM140 allows definition of a fourth type of analog input: "Volt/Ampere Low-End Reliable." At this software setting, zero volts is a reliable value. The Low-End Reliable setting applies to all AI types on a DCM140, whether via single- or dual-point FMs.

Outputs

The DCM140 executes digital-to-analog (user-configurable) commands through output function modules. It has a slot capacity for ten FMs. Most output FMs occupy one slot, and output signals to a single device. There are two exceptions:

- The Output Analog Pneumatic (OAP101/102) occupies two slots and controls a single device. (You may wish to use the newer OAP121, which occupies one slot and also controls a single device.)
- The Output Analog (OAN) occupies a single slot, but controls two independent analog devices.

Depending on the FM mix, the DCM140 supports up to 20 output devices. Below is a table of the output function modules, along with the kind of signals they output.

Table 4: Output Function Modules

Module	Output Signals
FM-OAE101-0	Output Analog Electrical: Provides selectable analog output or modulated current (0-20 mA sourced, 0-10 VDC sourced, 0-20 mA external source controlled).
FM-OAN101-0*	Output Analog: Provides two selectable analog outputs of current source at 0 to 20 mA (or 4 to 20 mA).
FM-OAI101-0	Output Analog Isolated: Provides an isolated power and ground (0-20 mA sourced, 0-10 VDC sourced, 0-20 mA external source controlled).
FM-OAP101-0 / FM-OAP102-0	Output Analog Pneumatic: An Electric/Pressure Transducer controlling pneumatic devices (0-20 psi). Requires two slots.
FM-OAP121-0	Output Analog Pneumatic: An Electric/Pressure Transducer controlling pneumatic devices (0-20 psi).
FM-OBE101-0	Output Binary Electrical: Provides a polarized 12 volt signal for incremental control of field devices.
FM-OTE101-0	Output Triac Electrical: Controls 3-wire increase/decrease signals (24 VAC, external supply required).
FM-ORM101-0	Output Relay Momentary: Control via Start/Stop Relays (Form A and Form C).
FM-ORE101-0	Output Relay Electrical maintained: Form C relay controls 2-wire circuit.
FM-ORL101-0	Output Relay Latched: Form C relay controls 2-wire, latched circuit.
FM-OSV101-0	Output Solenoid Valve: Controls 3-way pressure switching (0–20 psig).

* To use an FM-OAN101-0, the DCM140 must communicate to an NCM200 (or later), which contains Release 5.02 (or later) software.

Installation Procedures

Mounting

Install the DCM140 in Slots 1 and/or 5 of a 5-Slot NCU/NEU, or in Slot 1 of a 2-Slot NCU/NEU. These are the only slots that support function modules, which are required to condition signals into, and out of, DCM140s.

The repair NU-DCM140-700 can serve as a plug-in replacement for the DCM101-0.

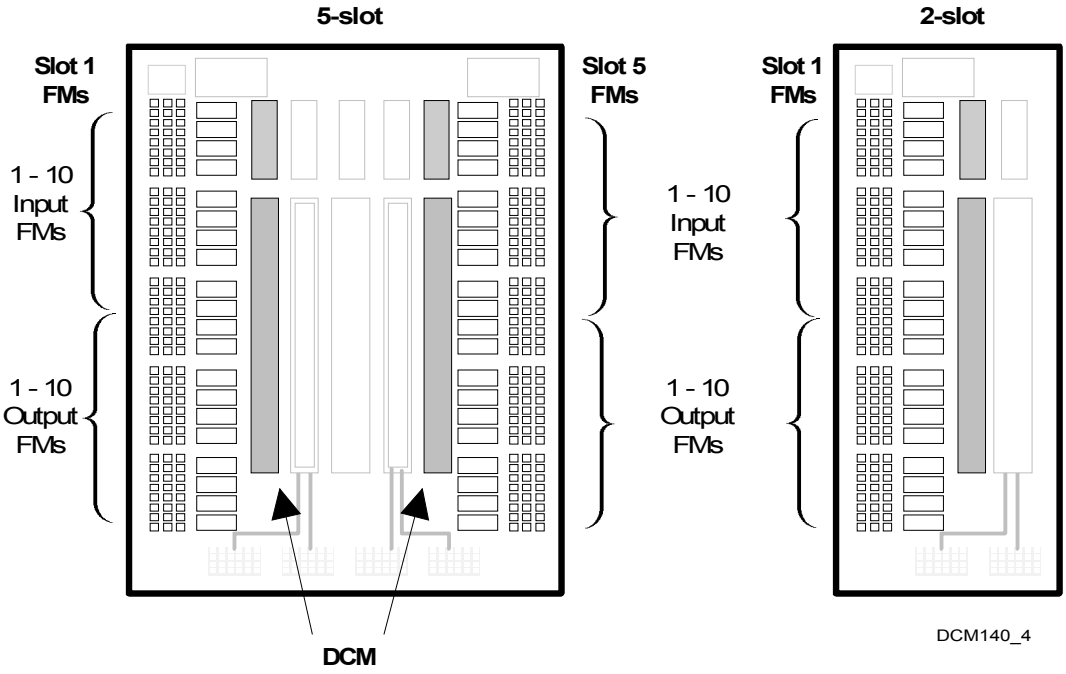


Figure 2: Valid DCM140 Slots with Function Module Locations

Software Setup

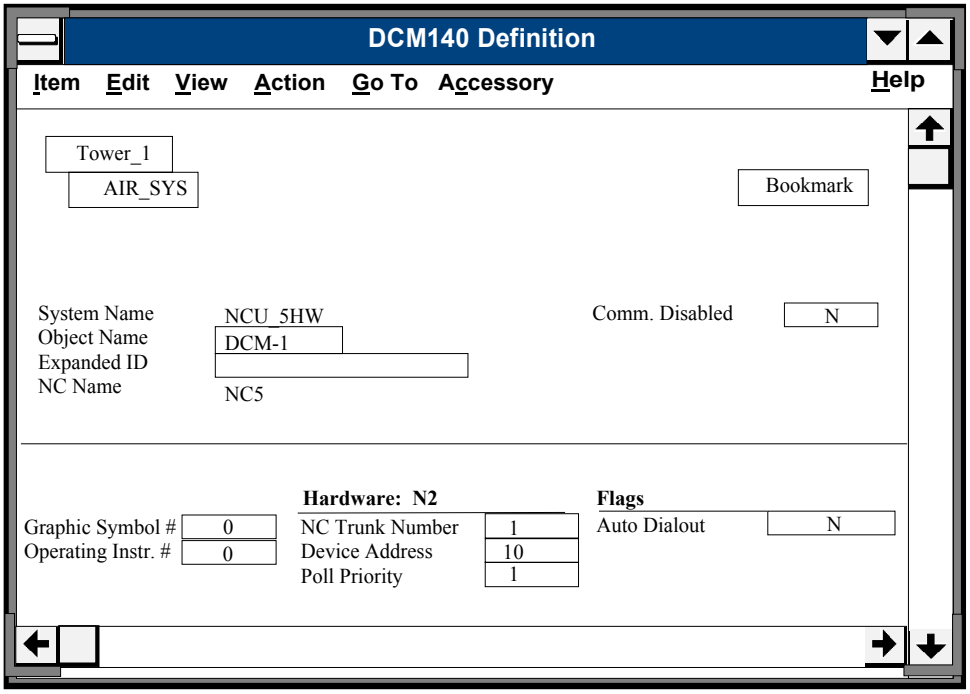
Define the DCM140 hardware object by entering data into the attribute fields on the Definition window. Figure 3 shows the Definition window as seen on the Operator Workstation; following is a description of each attribute's characteristics. This information defines the DCM140 module to the system. The *Software Architecture Technical Bulletin, (LIT-636010)*, provides an overall guide to objects and attributes. The *Operator Workstation User's Manual (FAN 634)* describes the procedural tasks to view and modify objects.

If the definition menu is for a new selection, all the fields have been initialized to a default state.

If the Definition Window is brought up from an existing DCM140 object, then all of the fields are filled in with the data from that object.

Fields that allow the data to be modified have the field value boxed in. When a field entry is modified, the new value is immediately verified when the field is exited.

For information on how to define the DCM140 with Data Definition Language (DDL), Graphical Programming Language (GPL), or JC-BASIC, refer to those manuals.



DCM140_5

Figure 3: Digital Control Module Definition Window

DCM140 Hardware Identification

Object Name

Enter any valid 1-8 character string. The object name must not already exist under the given system.

Expanded ID (Optional)

Enter any valid 0-24 character string.

Comm. Disabled

This flag shows whether communication over the N2 Bus is currently disabled for this device (Y or N). Disabling communication prevents commands, statuses, or alarms from being transmitted to or from the DCM140 over the network.

Hardware N2

NCM Trunk Number

(NCM101, 102, 401) This entry establishes the connection to the port on the NCM that contains the N2 submodule (1-2). The two ports on the NCM are where the user-selected submodules are installed: the upper port is 1, the lower port is 2.

(NCM200) This entry establishes the connection to the port on the NCM200 containing the built-in N2 interface. Select 1.

Device Address

Enter the N2 address (0-255) assigned to the DCM140. The address must agree with that set on the address switches, and must not be assigned to any other device on this N2 Bus.

Poll Priority

Enter the priority level (0-3, zero being the highest priority) at which this device should be polled.

Code Association to Graphics and Help Screens

Graphic Symbol

If a graphic symbol has been composed to associate with this object, enter the number of the graphic symbol (0-32767). Zero means no graphic symbol is associated with this object.

Operating # (Instructions Number)

When "Help" is selected for this object, a notepad appears containing user-modifiable operator instructions. Enter the number (0-32676) to reference the desired notepad. Zero means no operator instructions will be associated with this object.

Flags

Auto Dialout

In cases when a remote Operator Workstation is defined on a dial-up link, this selection (Y) forces an auto dialout from the NCM when the DCM140 issues a Critical 4 report.

Commissioning Procedures

Overview

Commissioning a DCM140 begins after the module and associated power supply module have been installed into the NCU/NEU, the field wires inspected, the function modules installed, and the objects defined in software. Refer to this technical bulletin as well as the *Network Control Unit/Network Expansion Unit Technical Bulletin* for information regarding these steps.

The general commissioning tasks are to set the DCM140 switches to their appropriate positions and confirm proper operation via the LED indicators and equipment response. The proper switch settings can be found in the job drawings prepared by the application engineer for the specific job. No special tools are necessary to commission the DCM140.

Switch Settings

Figure 4 illustrates the switch positions on the faceplate of the DCM140 module.

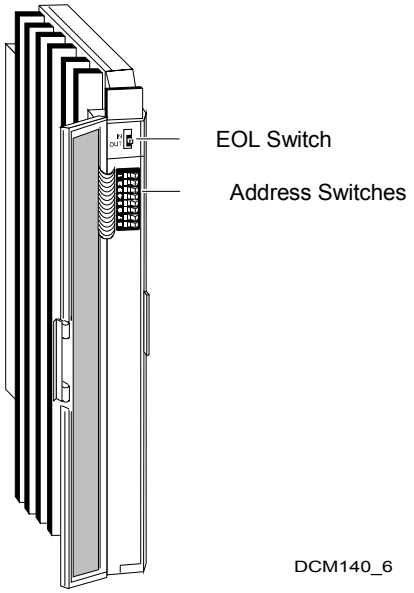


Figure 4: Switch Positions on DCM140 Module

N2 End-of-Line Switch

The N2 End-of-Line (EOL) switch is set to In (up) if the module is physically the last one on the N2 line (i.e., the N2 wires enter, but do not leave again on their way to another device). Only two N2 switches are set to the In position among all the devices connected to any individual N2 network. For more information, refer to the *N2 Communications Bus Technical Bulletin*, in the *Metasys Network Technical Manual*.

N2 Address Switch

The address switch is used by the NCM for polling, and is set to the same number as was assigned to the module in software. The address is set according to the numbering on the faceplate; the numbers are in binary format and vertically arranged with the least significant digit on top.

For example, if the module address is 119 (decimal), the binary representation is 01110111--switches 1, 2, 4, 16, 32, and 64 must all be set to the On (to the right) position (1+2+4+16+32+64 = 119), as shown in Figure 5.

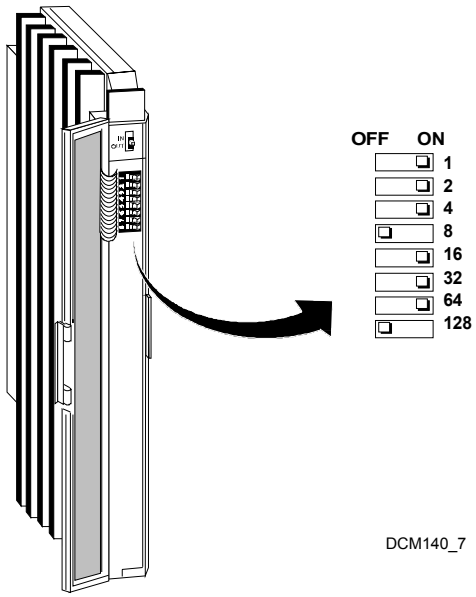


Figure 5: Example of Setting Address Switch

Power Up

LEDs

The LED indicators (Figure 6) supply evidence of the module's condition and help determine if the module is functioning properly.

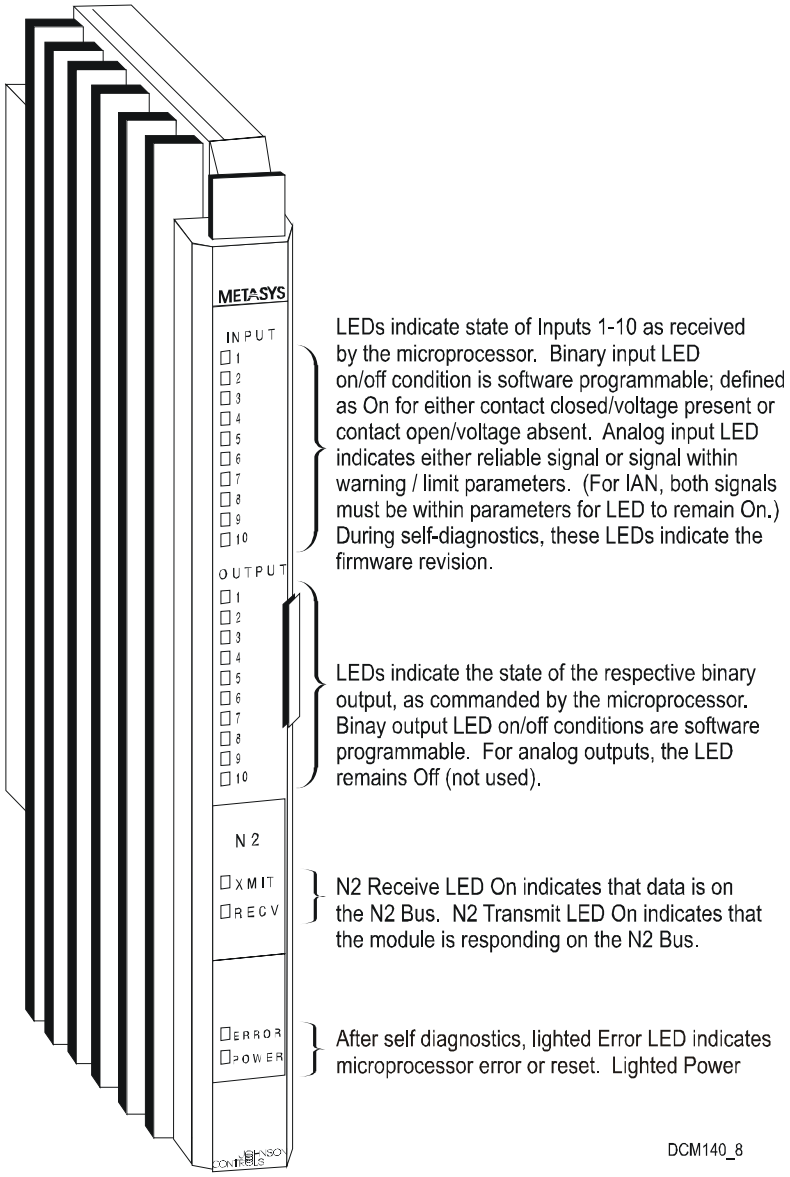


Figure 6: Identification of LED Indicators on DCM140

Self-Diagnostics

Turn on the power supply module to initialize the DCM140.

1. After applying power, the LEDs randomly light for a few seconds, responding to commanded positions. Then the DCM140 automatically resets itself.
2. An input LED lights for approximately ten seconds. This LED indication corresponds to the current firmware revision (e.g., input LED 1 for Revision 1). Internal diagnostics take place during the 10 second interval.
3. All the LEDs light for approximately one second, then light sequentially from top to bottom. This operation is a “lamp test” for the LEDs, and takes approximately ten seconds.

4. If a failure occurs in the firmware, an output LED lights to signal the failure code. Output LED 1, 2, or 3 lights for an SRAM failure, 4 for an N2 communication failure, and 5 for an EPROM failure. The DCM140 automatically resets itself. Listed below are error conditions that require replacing the DCM140:

   a. If the DCM140 continuously resets itself, a severe hardware failure has occurred. Replace the module.

   b. If the Error LED stays lit, a microprocessor error has occurred. Replace the module.

   c. If the Power LED turns off (and the power supply module is functioning properly), a power failure is occurring either in the connections between the power supply module and DCM140, or inside the DCM140. If possible, test the connections by installing a known functioning DCM140 module into the slot.

      - A functioning DCM140 that works in the slot verifies the connections. Replace the faulty DCM140.
      - If a functioning DCM140 fails in the slot, the problem may reside in the power supply module or NCU/NEU base frame. Refer to the *Network Control Unit/Network Expansion Unit Technical Bulletin* in this manual.

Fast Trend Operations

The DCM140 may reset when you perform consecutive Start/Modify Fast Trend operations from the Operator Workstation (OWS). This causes the DCM140 to exhaust its available RAM.

Perform a Stop Fast Trend operation following the initial start. You may then perform a Modify Fast Trend operation with the desired parameters. *Do not perform consecutive Start/Modify Fast Trend operations without executing a stop command between them.*

Note: This problem occurs in Release 5.02 of Metasys software and is fixed in Release 6.0.

Troubleshooting Procedures

Module

Perform the following steps to field check the DCM140. The input field checks must be performed while the N2 Bus is communicating (N2 Bus communications are checked in Step 3, below).

1. Ensure that the Power LED lights and remains lit to indicate that the supply voltage is good.
2. Verify that the Error LED never lights (with the exception at power on). If this LED constantly flashes, or remains illuminated, or if all the LEDs constantly flash, a severe hardware failure is indicated. Replace the module.
3. Next, verify that the device is being polled. This is evident if the XMIT (transmit) LED lights, which indicates that the DCM140 is replying to a poll.
   - If the RECV LED does not light, the DCM140 is not connected to the N2 Bus. Refer to the *N2 Communication Bus Technical Bulletin* in this manual.
   - If the RECV LED does light without the XMIT LED ever responding, perhaps no messages are being addressed to the DCM140. Ensure that the system is configured to poll the DCM140 by cross-checking the address in the Hardware Definition window with the address physically set by the N2 address switches.

     Note: Changing the N2 address requires cycling power to the DCM140 in order to reset and correct the address in the system software.
   - If the RECV and XMIT LEDs respond irregularly, and the Definition window lists the DCM140 as being Offline, the polarity of the N2 wire connection may be reversed. Inspect the N2 Communication Bus wiring to ensure that the same color of wire enters and exits the screw terminal. For further information, refer to the *N2 Bus Technical Bulletin Lit-636018* in this manual.

Inputs

Use the following procedure to configure the DCM140 inputs:

1. Ensure that the binary input LEDs on the DCM140 coincide with the "present state" indication at the NCM. This requires a comparison of the point's status, as seen on the Object Focus window or Network Terminal, with the actual condition of the LED.

Note: The LED on/off condition is user-defined in software, such that the LED light On may indicate either that the input contact is open or that the input contact is closed.

Analog input LEDs light as follows:

- If Alarm Limits are defined in software, the LED remains on for as long as the signal stays within the assigned warning limits.
- If limits are not defined in software, the LED remains on for as long as the signal is reliable (stays within hardware values).
- In the case of the IAN function module, which accepts two analog inputs, *both* inputs must have a reliable signal for the LED to remain on.

2. Force each input to change state, then check:
   a. The "present state" condition on the Object Focus window or Network Terminal, and
   b. The LED light to verify that the change was reported accordingly.
3. Follow these steps if input is evident from the LED lights, but in a non-functional or irregular pattern, the installed function module may be an incorrect type, or, if the function module is an IUN, the jumpers may be incorrectly placed.
   - Ensure from the engineering drawings that the installed function module is the correct one.
   - Refer to the *Input Universal Technical Bulletin* for proper switch settings and inspect the jumper positions on any questionable IUN function module.

Outputs

Use the following procedure to configure the DCM140 outputs:

1. *Binary Outputs:*

   Ensure that the *binary* output LEDs on the DCM140 coincide with the present state indication at the NCM (the analog output LEDs stay off). This requires a comparison of the point's status, as seen on the Object Focus window or Network Terminal, with the actual condition of the LED.

Notes: The LED on/off condition is user-defined in software, such that the LED light on may indicate either that the output contact is open or that the output contact is closed.

Analog Outputs:

The LEDs remain off (unused) for *analog* outputs.

2. Force each output to change state by overriding the present state via the Operator Workstation or Network Terminal, then check:

   a. The present state condition on the Object Focus window or Network Terminal (this step tests analog as well as binary outputs), and

   b. The LED light to verify that the change was reported accordingly (this tests binary outputs).

Note: Step 2 requires that the point database has been downloaded to the DCM140. If no download has ever been made, the LED lights will not indicate the present state.

3. If a field device responds erratically, or not at all, to an otherwise functioning DCM140, check:

   - To ensure that the appropriate type of FM is in the FM slot for that device.
   - The point object is defined with the correct slot number in software.

   If the problem cannot be corrected by a switch adjustment, terminal wiring adjustment, FM adjustment, or in software:

   a. Replace the module on the Object Focus window or Network Terminal, and

   b. Check the LED light to verify that the change was reported accordingly.

Note: A new feature has been added to the DCM140 product. A bumpless restart is available on DCM140s running the latest firmware release (B04). This new feature eliminates any bumps of resetting the analog outputs to zero when a new database is downloaded to the DCM. This can be an important feature for some types of mechanical equipment, like chillers, that are not designed to stop and restart quickly. See the *DCM140 'Bumpless' Control Following an NCU Download Application Note* (*LIT-6360205)* for more information.

LED Errors

There are a number of conditions under which the error LED light would light. The conditions can be grouped as normal (a restart of the DCM) or abnormal (an error occurring in the circuitry).

Normal conditions are:

1. The DCM power is cycled.
2. The NCM has been downloaded.

Abnormal conditions are:

1. The microprocessor does not service the power on reset circuit. This indicates a dead microprocessor.
2. Sanity errors can be caused by memory faults that result in bad data.
3. The Watch Dog Timer expires causing the LED to continuously light.
4. The chip, which lights the LED, may be the failure mode making the LED light turn on. Replace the DCM.

In general, the error LED light should not be on. It will be on temporarily for normal conditions when the above-noted situations occur. However, it should turn off when the situations are finished.

The abnormal conditions will result in continuously cycling or steady ON error LED situations. If either occurs, there is a fault within the DCM, and it should be replaced.

Ordering Information

Ordering Information

Table 5: Ordering information

Description	Johnson Controls Code Number
Digital Control Module 140	NU-DCM140-0
Digital Control Module 140, Repair Module	NU-DCM140-700

Specifications

Table 6: DCM 140 Specifications

Product	Digital Control Module 140 (NU-DCM140-0)
Microprocessor	80C188
Memory	48K x 8-Bit Static RAM 16K x 8-Bit E^2PROM 128K x 8-Bit EPROM
Inputs	10 Function Module Slots, handling up to 20 inputs
Input Accuracies	Voltage and Current: 12 bit resolution, (0.0244% at room temperature) 100 Ohm RTD (DIN platinum): Resolution = 0.07°F over full range 1000 Ohm RTD (JCI nickel): Resolution = 0.07°F over full range 1000 Ohm RTD (DIN platinum): Resolution = 0.10°F over full range 1000 Ohm RTD (JCI silicon): Resolution = 0.05°F over full range
Outputs	10 Function Module Slots, handling up to 20 outputs
Output Accuracy	Resolution is 10 bits (0.0977% over the full range). Output accuracy is further affected by the individual output function module.
Source Power	Power is from the PWR in the NCU/NEU
Ambient Operating	0 to 50°C (32 to 122°F)
Conditions	10% to 90% RH
Ambient Storage	-40 to 70°C (-40 to 158°F)
Conditions	5% to 95% RH
Dimensions (H x W x D)	355 x 36 x 152 mm (14 x 1.5 x 6 in.)
Shipping Weight	1.18 kg (2.6 lb)
Agency Compliance	FCC, Part 15, Subpart J, Class A UL916 CSA C22.2 No 205
Agency Listings	UL Listed and CSA Certified as part of the Metasys Network

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

Notes

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