C-TRAC3

COMMUNICATION MANUAL

FOR

BACnet

UNIT MODEL NO. _____
UNIT SERIAL NO. _____
SERVICED BY: _____
TEL. NO: _____

CANADIAN HEAD OFFICE AND FACTORY

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T2G 4C8
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SALES OFFICES ACROSS CANADA AND USA

Retain instructions with unit and maintain in a legible condition.
Please give model number and serial number when contacting
Engineered Air for information and/or parts.

www.engineeredair.com

May 23 R2

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INTRODUCTION

The C-TRAC3 is a configurable logic controller designed for use with Engineered Air heating, cooling and ventilation equipment.

BACnet is a data communication protocol for Building Automation and Control Networks. Developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), its purpose is to standardize communication between building automation devices and systems from different manufacturers.

COMMUNICATION

The controller supports BACnet MS/TP RS-485 and BACnet/IP. The Baud rate can be adjusted from 9600 to 76.8k. The ASHRAE standard Baud rate is 9600 or 38400 for MS/TP networks. This manual describes the BACnet objects and the information contained in the controller. In this manual object points that can be written to are said to be EMS (Energy Management System) commanded.

Caution:

When connecting to any network, the network connection must be connected before turning on the power to the controller to ensure the network card communicates to the network.

BACnet DEVICE DEFAULT FACTORY SETTINGS

These default settings are configured on the PGD1 display with password access under NETWORKING – BMS CONFIGURATIONS. Update by changing the **no** to **yes** on the PGD1 also (cycle the power to save the changes).

	BACnet MS/TP
Instance	77077
Baud Rate	38400
Address	77
Max Master	127
Max Info Frames	20

	BACnet IP
Instance	77077
IP	172.16.0.1
Subnet	225.225.0.0
Gateway	000.000.000.000
DNS 1	000.000.000.000
DNS 2	000.000.000.000
UDP Port #	47808 (not adjustable)

Note:
After making any changes to the default setting cycle the power to the controller to force the updates.

TEMPERATURE DISPLAY

The BACnet software is available in °C or °F. This is configured on the PGD1 display with password access under SERVICE.

PICS & BTL APPROVED

BACnet PICS (Protocol Implementation Conformance Statement) defines the options available by BACnet that are implemented in the controller. These PICS are available from the factory upon request. The following defines the BACnet objects available on the network. EMS is used to describe the objects that can be commanded by any 3rd party 'Energy Management System'.

COMMUNICATION WIRING

The BACnet MS/TP RS-485, & BACnet/IP communication cables must conform to BACnet specifications.

GENERAL

Write to Flash

- Description: During power-up, the operating and configuration variables stored in flash memory are brought into RAM memory where the program can read and write at will. All the object values in this manual are actually stored in RAM. Changes to some of the variables, such as set point, will be lost if the controller power is removed. The changes must be saved to flash to permanently save.
- R/W
- BACnet object: BV 49 (R/W)
- Return: On/Off

Caution:

As Flash memory has a limited number of write cycles, use this feature only when necessary.

EMS Discharge Air Setpoint

- Description: The input range must be between 0 to 255 °F with a 1°F resolution (-17.7 to 123.8°C with 0.55°C resolution). With EMS control enabled, the DT setpoint will equal the EMS setpoint.
- BACnet object: AV25 WRITE
- BACnet object: AV26 READ

EMS Secondary Discharge Air Setpoint

- Description: The input range must be between 0 to 255 °F with a 1°F resolution (-17.7 to 123.8°C with 0.55°C resolution). With EMS control enabled, the secondary DT setpoint will equal the EMS setpoint.
- BACnet object: AV27 WRITE
- BACnet object: AV28 READ

EMS Damper Minimum Position Setpoint

- Description: The input range must be between 0 to 100%.
- BACnet object: AV66 R/W
- Return value: %

EMS Unit Command On / Off

- Description: The EMS can command the C-TRAC3 on or off.
- BACnet object: BV42 R/W
- Return value: integer 0 = off, 1 = on

EMS Dehumidification Enabled

- Description: This is the object in which the EMS can enable the dehumidification function, assuming the equipment has this ability.
- BACnet object: BV43 R/W
- Return value: integer 0 = no dehumidification and 1 = start dehumidification

EMS Economizer Enabled

- Description: This is the object in which the EMS can enable the economizer function, assuming the equipment has this ability.
- BACnet object: BV45 R/W
- Return value: On / Off
- Off = Econo Enabled

EMS Cooling Enabled

- Description: This is the object in which the EMS can enable the cooling function, assuming the equipment has this ability.
- BACnet object: BV47 R/W
- Return value: On / Off
- Off = Cooling Enabled

EMS Heating Enabled

- Description: This is the object in which the EMS can enable the heating function, assuming the equipment has this ability.
- BACnet object: BV48 R/W
- Return value: On / Off
- Off = heating Enabled

CONTROL MODE

Unit On / Off Status

- Description: This object indicates the unit on/off status.
- Read only
- BACnet object: AV1044
- Return value: On or Off

TEMPERATURE SENSORS

The temperature sensors can be configured to read either Fahrenheit or Celsius by entering a password under SERVICE.

Ambient Temperature

- Description: Outdoor ambient temperature sensor, generally located in the outside air inlet.
- Read only
- BACnet object: AV11
- Sensor range: -58 to 302 °F -50 to 150 °C

Discharge Air Temperature

- Description: Primary leaving air discharge air sensor.
  - Hot Deck temperature sensor.
  - Dehumidification Reheat sensor.
- Read only
- BACnet object: AV12
- Sensor range: -58 to 302 °F -50 to 150 °C

Secondary Discharge Temperature Sensor

- Description: Multiple use sensor. If used, confirm its operation with the wiring diagram and unit function. Uses include, but are not limited to:
  - Not used
  - Used as a secondary discharge temperature sensor.
  - Room temperature sensor.
  - Return air temperature sensor.
  - Cold deck temperature sensor.
  - Dehumidification precool sensor.
- Read only
- BACnet object: AV13
- Sensor range: -58 to 302 °F or -50 to 150 °C

Discharge Air Temperature Setpoint

- Description: This is the actual controlling discharge air temperature set point after all the set point offsets and resets have been applied or it will equal the EMS PRIMARY SETPOINT.
- Read only
- BACnet object: AV14
- Set point range: Upper and lower set point limits have been preprogrammed into the C-TRAC3. Depending on the application, different limits may have been programmed for heating and economizer/mechanical cooling functions. Consult the unit function.

> ⚠ **The EMS setpoint will equal the discharge setpoint if there are no reset signals being implemented.**

BLOWER OPERATION

Blower Status

- Read Only
- BACnet object: BV10
- Return value: On / Off

VFD Speed Feedback

- Description: Indicates the variable frequency drive feedback signal corresponding to the 0-10Vdc signal feeding into the C-TRAC3. if the unit is equipped with a VFD.
- Read only
- BACnet object: AV10
- Return value: 0 to 100%

COOLING

Cooling Status – Mechanical Cooling On / Off

- Read Only
- BACnet object: BV50
- Return value: On / Off

External Cooling Lockout - A

- Read Only
- BACnet object: BV14
- Return value: On / Off

Cooling Lockout – Low Ambient Temperature

- Read Only
- BACnet object: BV13
- Return value: On / Off

VFD Cooling Lockout – Limit Stages due to Low Air Volume

- Description: The number of maximum allowable stages of compressors is limited as the total air volume decreases on units equipped with variable air volume control.
- Read Only
- BACnet object: BV18
- Return value: On / Off

Cooling Stages % On

- Description: Indicates the percentage of total stages of mechanical cooling that is being commanded to operate. To know the exact number of compressors running, additional decoding is required based on total number of cooling stages in the unit.
- Read only
- BACnet object: AV17
- Return value: 0 to 100%

Cooling Modulated Output

- Description: Indicates the level of modulating cooling output for mechanical cooling or chilled water.
- Read only
- BACnet object: AV18
- Return value: 0-100%

ECONOMIZER / DAMPERS

Damper Minimum Position

- Description: Indicates the required minimum position volume setpoint. The minimum position is normally set by the BACnet EMS, but may be preset by the face mounted C-TRAC3 pot, remote pot, 0-10Vdc control signal or PDA.
- Read only
- BACnet object: AV7
- Return value: 0-100%

Economizer Mode

- Read Only
- BACnet object: BV15
- Return value: On / Off

Damper Contact DM Closed

- Description: Binary output DM closed. Normally this output is used for enabling a 2 position damper actuator. Refer to the wiring diagram and unit function to determine.
- Read Only
- BACnet object: BV16
- Return value: On / Off

Economizer At Minimum Due To High Ambient

- Description: High ambient temperature exceeded setpoint, economizer driven to minimum.
- Read Only
- BACnet object: BV17
- Return value: On / Off

Damper Override Low DT (Discharge Temperature)

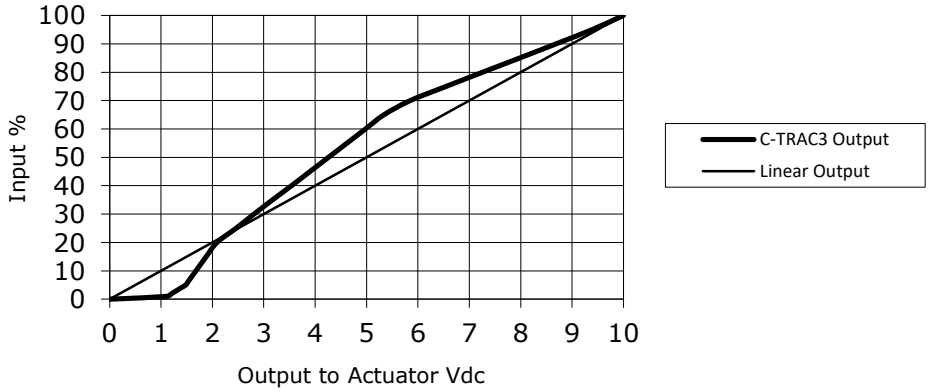
- Description: The minimum position is reduced to avoid low limit failure, to a maximum of 50% of its original setpoint.
- Read Only
- BACnet object: BV11
- Return value: On / Off

Damper % Open

- Description: Indicates the economizer output position in percentage. This number may not exactly match the economizer minimum position setpoint. The airflow does not increase linearly as the dampers open. For example, if the dampers are open 50%, the actual airflow is not 50%, but more like 70%. The C-TRAC3 has a preprogrammed 'damper linearization curve' to account for this to give a more accurate reflection of airflow volume. The low limit function will also reduce the minimum position if the discharge air temperature approaches the low limit setpoint (if used). Ambient compensation may be implemented to account for the thermal expansion of the cold outside air as it passes over the heat exchanger. The modulating output from the C-TRAC3 to the actuator will decrease from 10Vdc to 5Vdc as the ambient temperature falls from 70°F (21°C) to -20°F (-30°C).

- Read only
- BACnet object: AV19
- Return value: 0 to 100%

Damper Linearization Curve



UNIT MODES

Cooling Mode - Terminal A

- Description: Status of 24Vac input to disable cooling mode, usually wired from external cooling safeties or controls. Refer to the wiring diagram and unit function to determine.
- Read only
- BACnet object: BV5
- Return value: On / Off

Economizer Mode - Terminal E

- Description: Status of 24Vac input to disable economizer or mix box operation, usually wired from external safeties or controls. Refer to the wiring diagram and unit function to determine.
- Read only
- BACnet object: BV6
- Return value: On / Off

Heating Mode - Terminal HS

- Description: Status of 24Vac input to disable the heating, usually wired from external safeties or controls. Refer to the wiring diagram and unit function to determine.
- Read only
- BACnet object: BV7
- Return value: On / Off

Occupied Mode - Terminal FS

- Description: Status of 24Vac input to enable occupied operation, usually wired from external safeties or controls. Refer to the wiring diagram and unit function to determine.
- Read only
- BACnet object: BV4
- Return value: On / Off

Unoccupied Mode - Terminal K

- Description: Status of 24Vac input to enable unoccupied operation or a call for dehumidification, usually wired from external safeties or controls. Refer to the wiring diagram and unit function to determine.
- Read only
- BACnet object: BV8
- Return value: Enable / Disable

HEATING

Heating Modulating % Output

- Description: Displays the voltage output to the heating device.
- Read only
- BACnet object: AV20
- Return value: 0-100%

Heating Status

- Read Only
- BACnet object: BV39
- Return value: On / Off

Heating Lockout High Ambient Temperature

- Description: Heating is not allowed due to ambient temperature above setpoint.
- Read Only
- BACnet object: BV40
- Return value: On / Off

Heat Failure Lockout

- Read Only
- BACnet object: BV41
- Return value: On / Off

ALARMS

Air Flow Problem

- Description: Air flow switch or VFD feedback is detected prior to SA (Supply Air Output Contact) closing.
- Read only
- BACnet object: BV36
- Return value: Off / On

Ambient Sensor Alarm

- Description: Open sensor wiring or sensor failure.
- Read only
- BACnet object: BV26
- Return value: Off / On

Discharge Air Low Limit Lockout

- Description: Low primary discharge air temperature.
- Read only
- BACnet object: BV19
- Return value: Off / On

Discharge Air Sensor Alarm

- Description: Open sensor wiring or sensor failure.
- Read only
- BACnet object: BV24
- Return value: Off / On

Secondary Discharge Air Sensor Alarm

- Description: Open sensor wiring or sensor failure.
- Read only
- BACnet object: BV25
- Return value: Off / On

Sensor Failure Alarm

- Description: Open sensor wiring or sensor failure (primary, secondary or ambient).
- Read only
- BACnet object: BV35
- Return value: Off / On

LMK or HE Failure Alarm

- Description: Indicates loss of heat due to external safeties not closing on electric heat (LMK) or direct fired (HE) equipment (optional).
- Read Only
- BACnet object: BV23
- Return value: Off / On

UNOCCUPIED OPERATION

The C-TRAC3 controller may have a preprogrammed unoccupied mode, with the EMS used only for monitoring. Refer to the C-TRAC3 IOM manual for more information. Normally, however, the BACnet head end will initiate the event. This would typically include provisions for night heat only, however night cooling can be allowed in a similar fashion:

Disable the economizer to minimum position.
Set the minimum position to 0%.
Set the discharge air temperature.
Enable the unit.

MORNING WARM-UP OPERATION

Similar to unoccupied mode, morning warm up may also be accomplished through the BACnet head-end program for a preset amount of time.

Disable the economizer to minimum position.
Set the minimum position to 0%.
Set the discharge air temperature to maximum.
Enable the unit.

CRD ADDITIONAL POINTS

Depending on the additional I/O requirements up to four different controls may be used, and each one has the same BACnet Variable assigned to the hardware I/O. Only the description for that variable will change.

If additional status points are added to the controller, the description (& BACnet Variables) can be found in the unit function on the electrical data sheets. The terminal # on the controller relates to the following BACnet Variable / Alarm Variable.

BI-1 =AV001/BV090&91 BI-2 =AV002/BV092&93 BI-3 =AV003/BV094&95
BI-4 =AV004/BV096&97 or BV075 BI-5 =AV005/BV098&99 or BV034 BI-6 =AV006/BV100&101 or BV033
BI-7 =AV008/BV102&103 BI-8 =AV009/BV104&105

ID-1 =BV003/BV076 ID-2 =BV058/BV077 ID-3 =BV059/BV078 ID-4 =BV060/BV079
ID-5 =BV061/BV080 ID-6 =BV062/DV081 ID-7 =BV063/BV082 ID-8 =BV064/BV083
ID-9 =BV065/DV084 ID-10 =BV066/BV085 ID-11 =BV067/BV086 ID-12 =BV068/BV087
ID-13 =BV069/BV088 ID-14 =BV070/BV089

Y-1 =AV62 Y-2 =AV63 Y-3 =AV64 Y-4 =AV65

C-1 =BV001 C-2 =BV002 C-3 =BV009 C-4 =BV012 C-5 =BV044 C-6 =BV046
C-7 =BV051 C-8 =BV052 C-9 =BV053 C-10 =BV054 C-11 =BV055 C-12 =BV056
C-13 =BV057

C-TRAC3 VARIABLE DESCRIPTION TABLE

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AV18	Cooling Modulated Output	8
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BV50	Cooling Status – Mechanical Cooling On/Off	7
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BV47 (R/W)	EMS Cooling Enabled	6
AV66 (R/W)	EMS Damper Minimum Position Setpoint	5
BV43 (R/W)	EMS Dehumidification Enabled	5
AV25 (W)	EMS Discharge Air Setpoint	5
AV26 (R)	EMS Discharge Air Setpoint	5
BV45 (R/W)	EMS Economizer Enabled	6
BV48 (R/W)	EMS Heating Enabled	6
AV27 (W)	EMS Secondary Discharge Air Setpoint	5
AV28 (R)	EMS Secondary Discharge Air Setpoint	5
BV42 (R/W)	EMS Unit Command On/Off	5
BV14	External Cooling Lockout - A	8
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BV25	Secondary Discharge Air Sensor Alarm	11
AV13	Secondary Discharge Air Temperature	7
BV35	Sensor Failure Alarm	12
AV1044	Unit On/Off Status	6
BV8	Unoccupied Mode - K	10
BV18	VFD Cooling Lockout – Limit Stages due to Low Air Volume	8
AV10	VFD Speed Feedback	7
BV49 (R/W)	Write to Flash	5

CRD OPERATION

To move between pages press either DN [↓] or UP [↑] .

To escape from modifying an entry press ESC [Esc] .

To make any adjustments you must 1st enter the password, press ENT [↵] then UP [↑] or DN [↓] to change the password #, press ENT [↵] and continue till the password is entered and finally press ENT [↵] when complete.

To modify a manual value, move to the page that allows manual changes to the setpoint. Press ENT [↵] and then press DN [↓] to decrease and UP [↑] to increase the value. When the appropriate value has been set, press ENT [↵] to save.

To ensure the value is not lost in the event of a power failure or equipment servicing, be sure to save it. Go to save setpoints then ENT [↵] and UP [↑] for on, then press ENT [↵] to save.

To restart the equipment from the CRD go to Enable Unit and press ENT [↵] then press UP [↑] for on , then press ENT [↵] to restart the equipment.

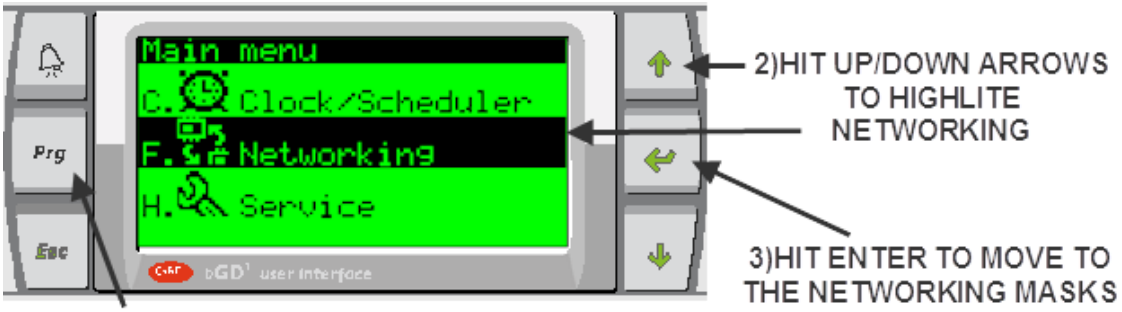
Clock / Scheduler

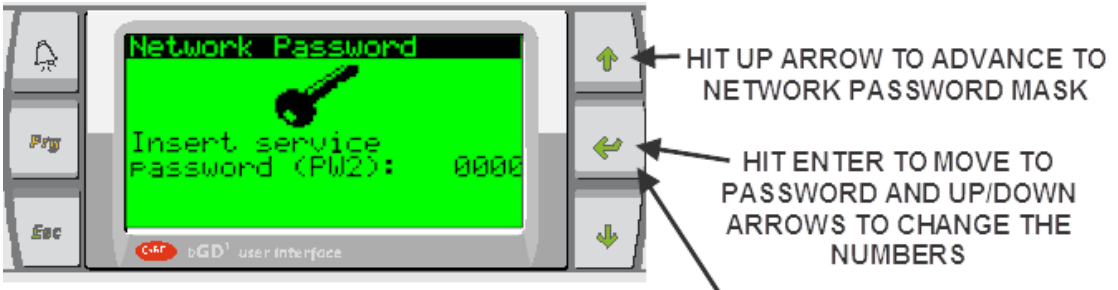
If the time clock/scheduler is enable press ENT [↵] on the clock/scheduler to go to the time and date page. Press the ENT [↵] to change the dates and times. Press the DN [↓] to go to the scheduler page. The scheduler # can have up to 7 different schedules with different on/off times and days of the week. Press ENT [↵] to advance to the time on, time off and days enabled per schedule #.

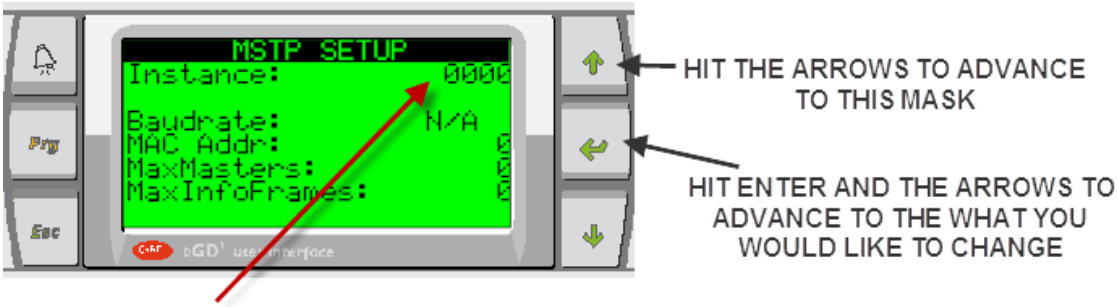
WARNING:

When connecting to any network the network connection must 1st be connected before turning on the power to the controller to ensure the network card communicates to your network.

To change the network inputs the following guide can be used.







1)HIT ENTER TO HIGHLITE READ

2)HIT THE ARROW TO CHANGE THE READ TO WRITE

3)HIT THE ENTER TO ADVANCE TO NO

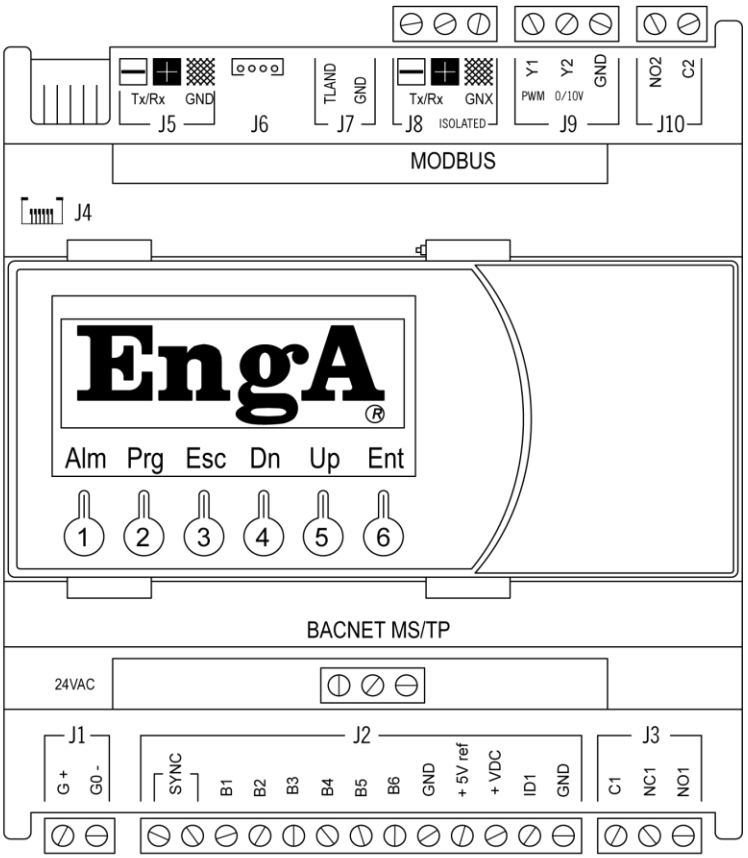
4)HIT THE UP ARROW TO CHANGE THE NO TO YES (YES WILL APPEAR FOR 4 SEC THEN CHANGE BACK TO NO) YOU HAVE JUST UPDATED YOUR CHANGES TO THE CONTROLLER. AFTER THIS YOU MUST CYCLE THE POWER ON THE CONTROLLER TO SAVE THESE CHANGES.

5)NOW GO BACK TO THE NETWORKING MASK AND CONFIRM THAT YOUR CHANGES ARE CORRECT.

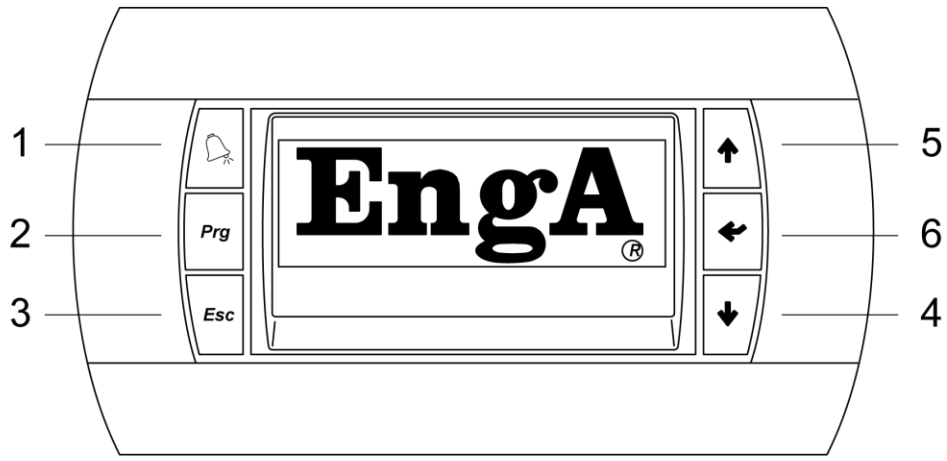
NOTE: When cycling the power to the controller, ensure all network connections are connected, wait 30 sec before you repower the controller, and wait 3 minutes for the Bacnet card (MS/TP or IP) to come on line with the controller. After these delays go to the above mask to read the changes that were just made. Change the function to READ and change the update to YES and hit enter key. To exit this mask hit the Prg button and reenter the network mask to view the changes.

DRAWING

CRD LCD DISPLAY



BUTTON #1 = Alarm Page (used to acknowledge and see alarms).
BUTTON #2 = Program Page (used to see, service, networking and time scheduler options).
BUTTON #3 = Escape (cancel an entry or action).
BUTTON #4 = Down Page (go to next page down or it is used to increment / decrement a value.
BUTTON #5 = Up Page (go to next up or it is used to increment / decrement a value.
BUTTON #6 = Enter (advances to the next page and adjustable variables).



HAND HELD LCD DISPLAY