DYNAGEN®

control solutions you can trust

RA400

DynaGen Remote Annunciator

For use with the GSC400 and TG410.

Installation and User Manual – Revision 2.0

Full Version File: MAN-0081R2.0, RA400 User Manual.doc, October 2015

Thank You For Purchasing This DynaGen Product

Please Read Manual Before Installing Unit

Receipt of Shipment and Warranty Return Information

Upon receipt of shipment, carefully remove the unit from the shipping container and thoroughly examine the unit for shipping damage. In case of damage, immediately contact the carrier and request that an inspection report be filed prior to contacting DynaGen.

All returned items are to be shipped prepaid and include a Return Material Authorization (RMA) number issued by DynaGen. RMA forms are available by contacting DynaGen Technical Support through the contact methods listed below.

Limited Warranty

The RA400 Remote Annunciator carries a one year warranty. For more information refer to the standard terms and conditions of sale at http://www.dynagen.ca.

Support

For up to date manuals and other support see http://www.dynagen.ca/support.

We welcome your comments and suggestions. Please contact us at:

DynaGen Technologies Inc.
Phone: 1-888-396-2436
(902) 406-0133
Fax: (902) 567-0633
Email: support@dynagen.ca
WEB SITE: www.dynagen.ca

RA400 Specifications

<table>
<tr><td>Uses/Locations</td><td colspan="4">Intended for indoor, stationary mounting only. Please consult factory for outdoor or high vibration locations.</td></tr>
<tr><td>GSC400 Firmware Requirement</td><td colspan="4">GSC400 firmware version 2.00 is required and version 2.03 or latter is recommended. See installation instructions for more information.</td></tr>
<tr><td>VDC Rating</td><td colspan="4">6 to 30 VDC</td></tr>
<tr><td>DC Power</td><td colspan="4">Min*: 1.3 Watts at 12VDC (109mA), 1.75 Watts at 30VDC (59mA)
Max: 3 Watts (250mA at 12V, 125mA at 24V)</td></tr>
<tr><td>Operating Temp</td><td colspan="4">-40°C to +85°C (-40°F to +185°F)</td></tr>
<tr><td rowspan="20">Annunciators</td><td rowspan="2">Type</td><td colspan="3">LED Indication</td></tr>
<tr><td>Green (Normal)</td><td>Amber (Warning)</td><td>Red (Failure)</td></tr>
<tr><td>Overcrank</td><td></td><td>X</td><td>X</td></tr>
<tr><td>Overspeed</td><td></td><td>X</td><td>X</td></tr>
<tr><td>Emergency Stop</td><td></td><td></td><td>X</td></tr>
<tr><td>High Engine Temperature</td><td></td><td>X</td><td>X</td></tr>
<tr><td>Low Oil Pressure</td><td></td><td>X</td><td>X</td></tr>
<tr><td>Low Coolant Level</td><td></td><td></td><td>X</td></tr>
<tr><td>Low Coolant Temperature (Low Engine Temperature)</td><td></td><td>X</td><td></td></tr>
<tr><td>Low Fuel Level</td><td></td><td>X</td><td>X</td></tr>
<tr><td>Communication Status</td><td>X</td><td></td><td>X</td></tr>
<tr><td>Not In Auto</td><td>X</td><td></td><td>X</td></tr>
<tr><td>High Battery Volts</td><td></td><td>X</td><td>X</td></tr>
<tr><td>Low Battery Volts</td><td></td><td>X</td><td>X</td></tr>
<tr><td>Common Fault</td><td></td><td>X</td><td>X</td></tr>
<tr><td>Low Cranking Volts</td><td></td><td>X</td><td></td></tr>
<tr><td>Battery Charger Failure</td><td></td><td></td><td>X</td></tr>
<tr><td>User Configurable 1</td><td></td><td>X</td><td>X</td></tr>
<tr><td>User Configurable 2</td><td></td><td>X</td><td>X</td></tr>
<tr><td>System Ready</td><td>X</td><td></td><td>X</td></tr>
<tr><td>Generator Running</td><td>X</td><td></td><td></td></tr>
<tr><td>EPS Supplying Load</td><td>X</td><td></td><td></td></tr>
<tr><td colspan="4">LEDs will gradually dim when temperature rises above 30^{0}C to protect the LEDs and prolong their life.</td></tr>
<tr><td>Audible Alarm (buzzer)</td><td colspan="4">71 to 86dB at 2ft Typ. Depending on installation, this could be lower.</td></tr>
<tr><td>Front Panel Button</td><td colspan="4">• Alarm Silence
• Lamp Test</td></tr>
<tr><td>Modbus Communications</td><td colspan="4">• 2 wire (simplex)
• 9600 and 19200 BAUD rates supported
• Built in terminating resistor (selectable by jumper on board)
• Isolated
• Max 2800ft run with Beldin 9841</td></tr>
<tr><td>RS232</td><td colspan="4">• Firmware updates via RS232</td></tr>
<tr><td>User Inputs</td><td colspan="4">Two digital inputs (16V input maximum, reverse polarity protected)</td></tr>
<tr><td>Dimensions</td><td colspan="4">W x H x D: 203.2 x 203.2 x 38.1 mm (8 x 8 x 1.5 in.)</td></tr>
<tr><td>Weight</td><td colspan="4">0.68 Kg (1.5 Lb)</td></tr>
<tr><td colspan="5">* Three LEDs Indicators are on in standby: “Communication Status”, “Not In Auto”, and “System Ready”. The RA400 maintains communication. There is no sleep mode for the RA400.</td></tr>
</table>

Table of Contents

1. RA400 Remote Annunciator

The RA400 is a remote annunciator panel for the GSC400 and TG410 controllers. It has 20 LED indicators to allow personnel to monitor the controller from a remote location.

The RA400 can either act as a master or a slave. When set as a master the RA400 can also copy the controller information to up to three slave RA400 units. See the installation/configuration section of this manual for important

1.1 This Manual

This manual is divided into two sections:

1. Hardware installation / Configuration
2. Operation

1.2 RA400 Product Number Identification

The RA400 series product numbering scheme (i.e. serial number) provides various information (including options selection by the customer) about the unit. A serial number has the format given in Figure 1.

RA400 - _ _ - _ _ _ _ _ - Rev _._ _

Position 1-5	Position 7-8	Position 10-14	Position 19-22
Series	Labeling	Identifier	Revision
Series: RA-400	LS=Standard LX=no label	Uniquely indentifies the particular unit.	Hardware Revision Number

Figure 1 – RA400 product numbering scheme

2. RA400 Series Installation and Wiring

2.1 Safety / Information

Generator systems contain high voltage circuitry. Failing to power down and lock out equipment can cause damage to the equipment, or injury or death to personnel. The symbols below will be used in this document to classify information.

Indicates something that you should take special note of but that is not a threat to safety.

Indicates a potential for injury or death.

This is similar to Danger above but relates specifically to conditions where high voltage is encountered.

Cautions:

When the RA400 is set as a master do not connector other modbus devices to addresses 2, 3, and 4 if harm can occur to personel via these devices. The RA400 uses these addresses automatically for it's copy feature. Unexpected behaviour may occur.

2.2 GSC400 Firmware Version

GSC400 firmware version should be at least 2.00 and above with version 2.03 recommended.

To determine the firmware version cycle power to the GSC400 and observed the screen. The hardware and firmware versions will display for a few sections before the GSC400 goes into the OFF or AUTO mode.

For GSC400 firmware version 2.00 the default Modbus BAUD rate is set to 57600. This will have to be changed to 9600 (RA400 default) or 19200 as these are the only two BAUD rates the RA400 supports.

2.3 Mounting Location

The RA400 Remote Annunciator must be properly mounted for safe operation. Caution must be taken at the installation site to make sure the site is free from condensing humidity, extreme temperature fluctuations beyond -40^{0}C to 85^{0}C, and corrosive materials.

Intended for indoor, stationary mounting only. Please consult factory for outdoor or high vibration mounting locations

The annunciator is designed to fit in a common 8” x 8” x 4” breakout box – for example Hoffman ASG8X8X4. Refer to Figure 14 – Hoffman 8x8x4Pull B on page 39. Also see ***Figure 2 – Size and placement of mounting holes*** below for the RA400 mounting dimensions.

2.3.1 RA400 Mounting Dimensions

Figure 2 gives the dimensions of the RA400 mounting holes in inches.
The dimensions of the PCB behind the front plate is 5.2”(W) x 6”(L). The depth of the RA400 is approximately 0.9” (without connectors plug in) and 1.2” (connectors plugged in).

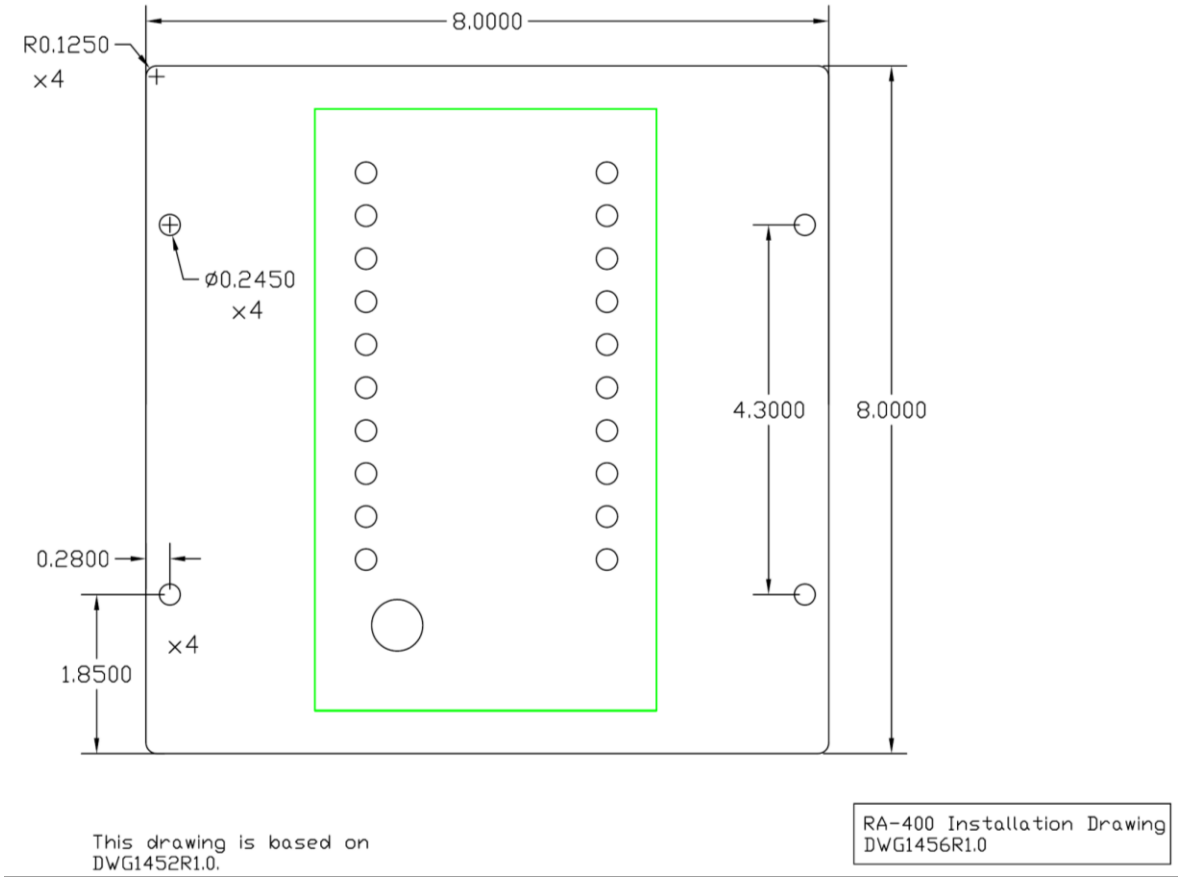


Figure 2 – Size and placement of mounting holes (not to scale).

2.4 RA400 Terminals

The RA400 can be powered from a 12VDC or 24VDC source. **It will not operate below 6VDC and voltages above 30VDC may damage the unit.**

All connectors on the RA400 use plug in screw terminals which are included with the RA400. The installer inserts the wire(s) into the screw terminal, secures the wire using a flathead screwdriver, and plugs the screw terminal into the terminal socket on the RA400.

Table 1 on page 11 lists the minimum wire size, maximum current capacity, name, and function of each circuit. **The wire gages given in the table are the minimum recommended only.**

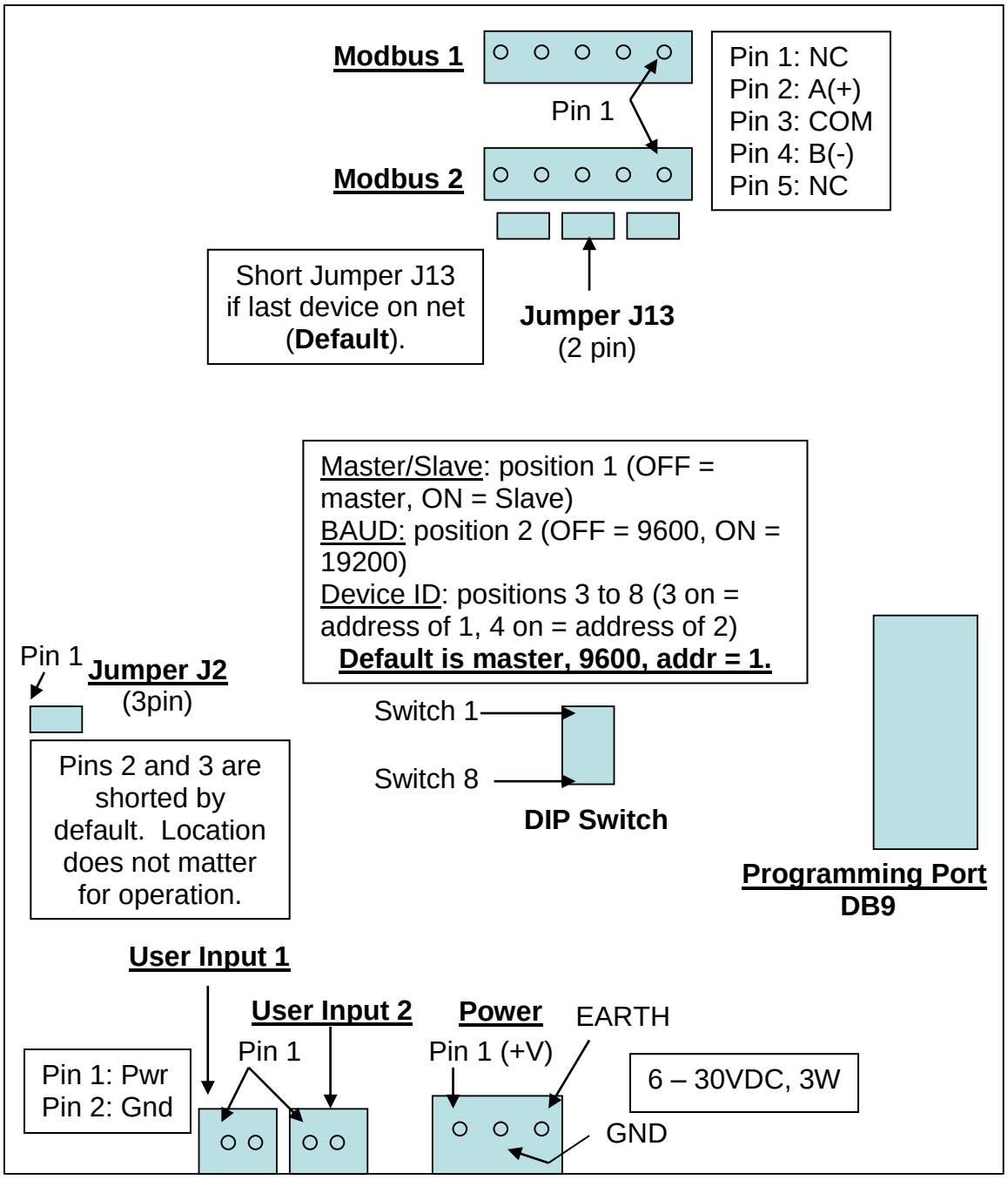


Figure 3 – RA400 terminals as seen from the rear. Refer to following tables for more detailed information.

Table 1 – RA400 Terminal Details

Wire sizes given below are the minimum recommended only. Depending on the length of the cable run you may require a larger gauge wire.

Power (J14)	Terminal	Terminal #	Wire Size (AWG)	Function
	+VDC [1]	1	18	Main power for the device.
	COM	2	18	Ground for the device.
	Earth	3	18	Chassis or electrical earth. [2]
	[1] Allowable voltage range is +6VDC to +30VDC. [2] Connect this to the chassis of the generator or ground of the electrical system (preferred).			

Modbus (J9, J10)[1]	Terminal	Terminal #	Wire Size (AWG)	Function
	NC	1	N/A	Do not connect.
	A (+)	2	24	The positive (A) for 2-wire Modbus.
	COM[2]	3	24	Modbus common (ground).
	B (-)	4	24	The negative (B) for 2-wire Modbus.
	NC	5	N/A	Do not connect.
	[1] There are two terminals provided to enable the installer to daisy chain multiple RA400 units together. **If the RA400 is the last device on the communications bus, the two pins of J13 (the Modbus terminating resister jumper) must be shorted together (factory default).** [2] This **must** be connected to the GSC400 Modbus ground.			

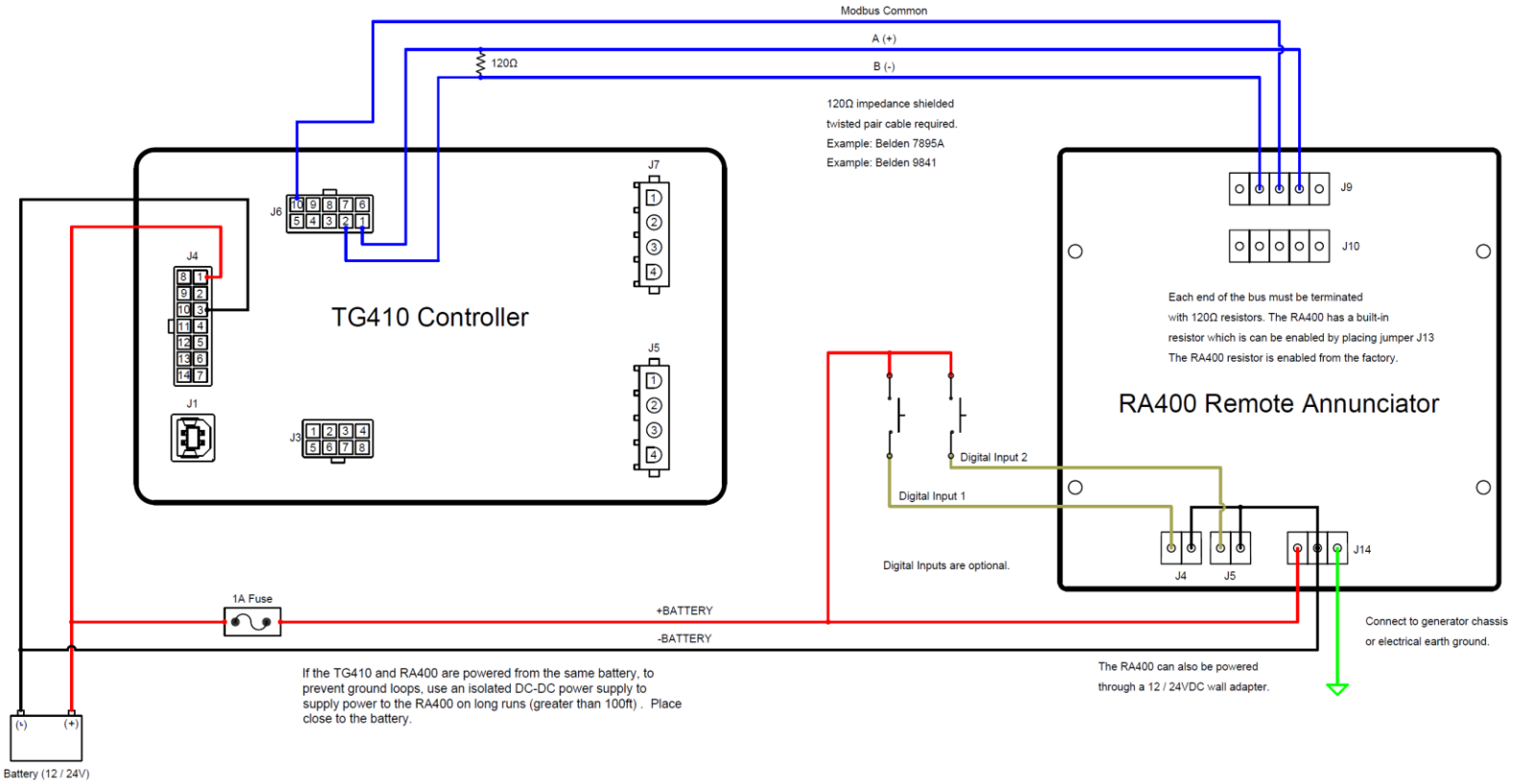
User Input 1 and 2 (J4, J5)	Terminal	Terminal #	Wire Size (AWG)	Max. Voltage (V)	Function
	Power	1	18	30	Digital input terminals.
	Ground	2	18	N/A*	
	Apply voltage across the two pins to activate the digital input. The digital inputs have specific functionality. See section 3.7 Digital Inputs 1 and 2 on page 25. **Reverse polarity protected to 30V. Damage will occur if the voltage exceeds this.**				

Table 2 – RA400 DIP Switch		
Eight Position Dip Switch (SW2)	**Switch**	**Function**
	1	Controls whether the RA400 is a master or slave. OFF = master, ON = slave. **Default is OFF (master).**
	2	These control the BAUD rate: OFF = 9600, ON = 19200. **Default is OFF (9600).**
	3	Switches 3 to 8 are the device ID of the GSC400 unit connected to the RA400 (if switch 1 is OFF) or the device ID of the RA400 (if switch 1 is ON). The device ID can range from 1 to 63. **Default is address 1.** See Table 3 to determine the position of the switches for other addresses.
	4	
	5	
	6	
	7	
	8	
Note: All DIP switches in the OFF position places the RA-400 in a factory test mode. To exit this mode move at least one switch to on position and cycle power.		

Table 3 – Device ID DIP Switch Position

OFF is indicated by a series of lines. "ON" is used to denote that the switch is in the "ON" position.

Device ID	Switch 3 (x1)	Switch 4 (x2)	Switch 5 (x4)	Switch 6 (x8)	Switch 7 (x16)	Switch 8 (x32)
Software specified.	---	---	---	---	---	---
1	ON	---	---	---	---	---
2	---	ON	---	---	---	---
3	ON	ON	---	---	---	---
4	---	---	ON	---	---	---
5	ON	---	ON	---	---	---
6	---	ON	ON	---	---	---
7	ON	ON	ON	---	---	---
8	---	---	---	ON	---	---
9	ON	---	---	ON	---	---
10	---	ON	---	ON	---	---
…and so on, until…	To determine the position of the switches for device IDs between 10 and 28 turn on the switches whose numbers (shown above in brackets) add up to the device ID). There is a unique combination for each device ID. E.g. Device ID 11 = Switch 1, Switch 2, and Switch 4 on = 1 + 2 + 8 = 11, all other switches are off.					
60	---	---	ON	ON	ON	ON
61	ON	---	ON	ON	ON	ON
62	---	ON	ON	ON	ON	ON
63	ON	ON	ON	ON	ON	ON



RA400 DIP Switch Settings	
1	OFF = Master, ON = Slave
2	Baud: OFF = 9600, ON = 19200
3	Switches 3-8 Device Address
4	Addresses 1-63 Available
5	DIP Switches are equal to
6	binary values when converting to
7	a decimal number. See RA400
8	manual for more information.

Digital Input 1 Function	
1	If controller is in OFF mode it will place it in the AUTO mode.
2	If the controller is in any mode other than OFF, it will place it into OFF mode. This includes shutting down the engine if it is currently running. Cooldown time is skipped during this operation.

Digital Input 2 Function	
1	If controller is in AUTO mode it will start the engine.
2	If the engine is running it will shutdown the engine. This includes all normal shutdown functions such as cooldown. The controller returns to AUTO mode after shutdown.

Power Wire Gauge and Distances	
14	1800 - 2800ft (549 - 853m)
16	1125 - 1800ft (343 - 549m)
18	700 - 1125ft (213 - 343m)
20	450 - 700ft (137 - 213m)
22	0 - 450ft (0 - 137m)

NOTE: Wireless solution available for applications with long distances or wiring issues. Contact factory for more information.

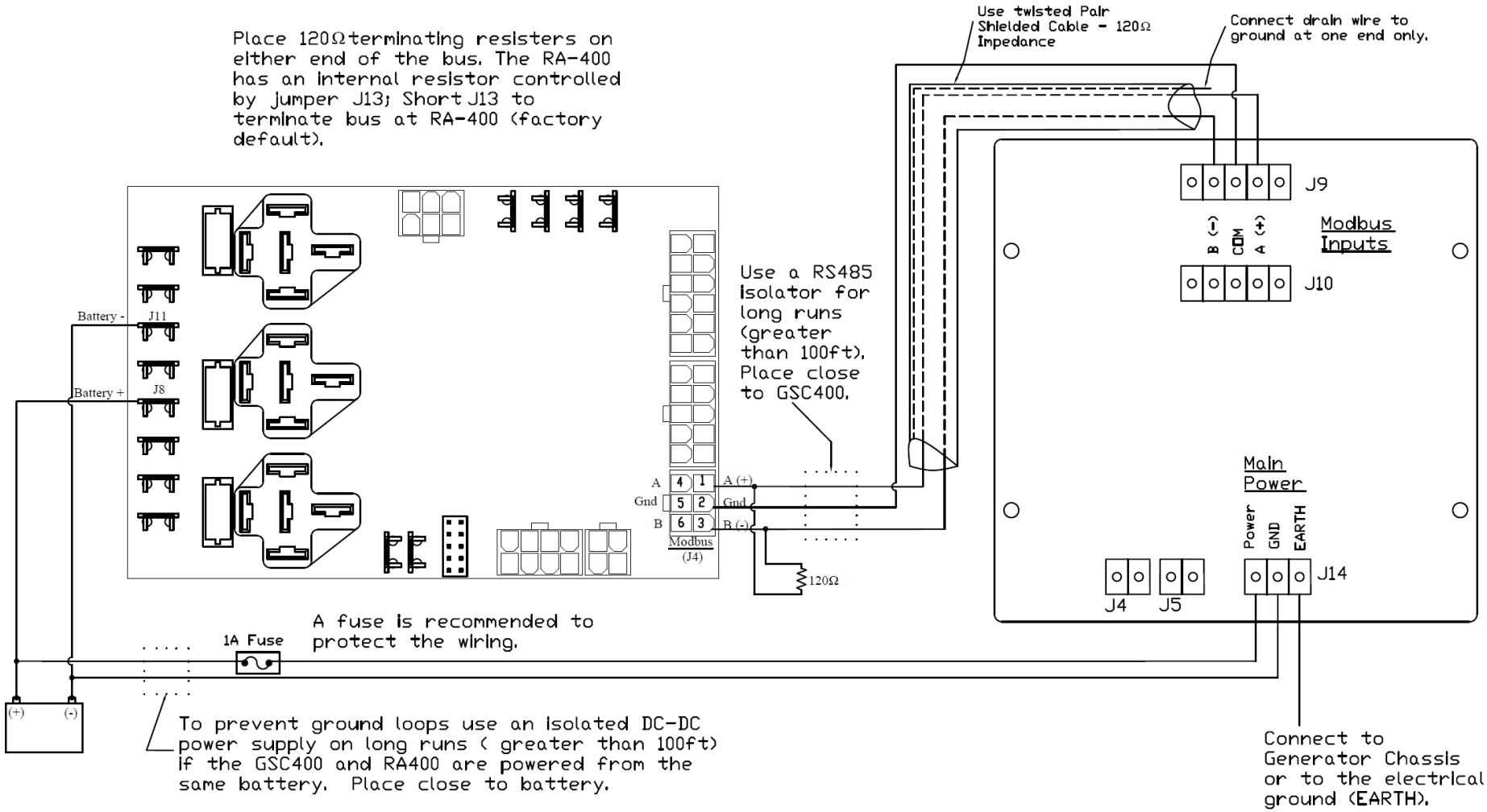
DRAWING NOTES
NOTE 1:
NOTE 2:
NOTE 3:
NOTE 4:
NOTE 5:
NOTE 6:
NOTE 7:
NOTE 8:

Your application and wiring may vary. Refer to full user manual for detailed information on using your products.

DYNAGEN
power controls you can trust

Project Name	Wiring Diagrams
Drawing Name	TG410 to RA400 Connections
Drawing Number	DWG1530
Drawing Revision	1.1.0
Drawing Scale	Not To Scale
Drawing Size	ANSI-B / Ledger
Created On	03/13/2013
Modified On	09/23/2014
Created By	Everett Pattison
Modified By	WWM

Figure 4 TG410 to RA400



RA-400 System Wiring Diagram
DWG1453 Rev 2.0

Figure 5 – GSC400 to RA400

2.5 RA400 Installation Guide

Important: Pretest the controller and RA400 by connecting them directly to each side of the DynaGen harness (**G3/G4**) and confirm proper communications.

This section will step you though the installation and setup of the RA400 to communicate with the DynaGen controller. While reading the following sections refer to Table 4 below for the required and optional parts and tools.

Table 4 – RA400 Installation Part List

Ident.	Item	Manufacturer and Part #	Elec. Supplier Part #	DynaGen Stock Code	Use
G2	Modbus two twisted pair shielded cable, 18AWG power, 20AWG modbus	Belden 7895A	N/A	N/A	Modbus A, B, and Gnd connections between controller and RA400.
G3	GSC400 DWG1454	Dynagen DWG1454	N/A	DWG1454	Premade 5ft adapter cable to plug into GSC400 with pigtails on other end.
G4	TG410 DWG1522	Dynagen DWG1522	N/A	DWG1522	TG410 5ft communication harness
H1	Power Plug in Terminal (J14)	On Shore Technology Inc EDZ950/3	www.DigiKey .com ED1718-ND	N/A	Replacement green terminal plug (3 pos).
H2	User In 1 / 2 Plug in Terminal (J4, J5)	On Shore Technology Inc EDZ950/2	www.DigiKey. com ED1717-ND	N/A	Replacement green terminal plug (2 pos).
H3	Modbus 1 / 2 Plug in Terminal (J9, J10)	On Shore Technology Inc EDZ950/5	www.DigiKey .com ED1720-ND	N/A	Replacement green terminal plug (5 pos).
I	Pull Box Type 1, 8x8x4”	Hoffman ASE8X8X4	N/A	ACC0109	Mounting box for RA400.
J	AC Power Supply (12V)[1]	Mean Well LPL-18-12	N/A	ACC0120	

[1] Power supply is fully enclosed (IP64 rating) and rated from -30^{0}C to 70^{0}C with derating after 50^{0}C. See pages 40 and 41 for the datasheet. Indoor use only.

2.5.1 Main RS485 Cable from Controller to RA400

Always run new wiring unless you can verify that its meets the below requirements. Using unknown wiring can result in unreliable communications. In the case of the GSC400 the controller can be damaged.

The communication cabling and its installation must meet these conditions:

1. A twisted pair cable with an impedance of 120Ohms (such as **G2**). Note the impedance rating of the cable is not the same as the resistance of its wires. Check with the cable manufacturer to ensure you have the proper impedance cable.
2. The wires for A and B need on a twisted pair.
3. A third wire is needed to connect the RS485 common between the controller and RA400. If using a shielded cable using the shield drain wire as the common is not recommended.
4. Each end of the bus must be terminated with 120Ohm resistors across A and B.

The following are recommendations:

1. A shielded cable is recommended if you are not sure if one is needed. Terminate the drain wire to ground on one side only.
2. If you are powering the RA400 from the battery, it is recommended not to run power and ground wires in the same cable/conduit as the Modbus communication wires to prevent noise from affecting communications.

2.5.2 Controller Connections

Ensure that the generator is disabled before doing any work on it or the controller.

DynaGen sells an accessory harness that connects directly to the GSC400 (**G3**) or TG410 (**G4**). The harnesses are 5 feet long. It is recommend that you cut the length so that it is no longer than 3 to 6 inches. Then connect it to the main cable (see previous section) using butt connectors or some other connection method. This length provides the best immunity against noise.

GSC400 Notes:

1. For long distances (> 100ft) use a RS485 optical isolator. The GSC400 is not optically isolated.
2. If the GSC400 is not the last device on the Modbus network cut the resistor from the harness.
3. If you are not powering the RA400 from the battery wrap the extra power and ground wires on the harness in electrical tape to prevent accidental shorting.

Modbus Common Note on Older GSC400 Units

Older GSC400 LXB / LSB units have an internal 100Ohm resistor between Modbus common and battery -. This may cause damage to the GSC400 Modbus transceiver in some applications. It is recommended to run a jumper from Modbus common to battery negative on the GSC400.

To determine if this resistor is in your unit disconnect the Modbus cable from the GSC400 and measure resistance from Modbus ground (common) on the GSC400 Modbus terminal (pin 2) to the GSC400 battery negative terminal. If it reads 100Ohms then your unit has the resistor.

2.5.3 Mount the 8 x 8 x 4" Pull Box

The RA400 is designed to fit in an 8x8x4" screw cover pull box. The RA400 replaces the screw cover and the four mounting holes on the RA400 align with the cover threads on the pull box.

The Modbus A, B, and common wires as well as the power and ground wires must be run into the panel. In addition the RA400 has an EARTH connection that must be connected to the ground of the electrical system.

The next section will detail how to make the connections to the RA400.

2.5.4 RA400 Connections

Refer to Table 1 – RA400 Terminal Details on page 11 when reading this section.

1. Connect the Modbus A, B, and ground wires to one of the two five-pin screw terminals. It does not matter which one but all three wires have to be on the same connector.

2. If the RA400 is not the last device on the Modbus network remove the jumper from J13.

3. Connect the RA400 EARTH wire – located on the three pin screw terminal, J14 – to the ground of the electrical system and the pull box (if used).

4. There are two options for powering the RA400: an AC-DC power supply or the genset battery.

   AC-DC Power Supply
   An AC-DC power supply can be used to power the RA400 from the building's electrical system. The RA400 requires at least 6VDC although it is recommended 9VDC or greater in case of voltage drops or other unforeseen issues.

   A simple two prong AC wall adapter can be used to provide power. It must be able to supply a **minimum of 3 Watts** (250mA at 12V, 125mA at 24V). Dynagen also sells a 12VDC power supply: ACC0120 (indoor use only).

Note: If powered locally without a battery the RA400 will lose power when the utility power is lost until the generator is running and supplying power.

Generator Battery

Connect positive and negative wires from the generator battery. Refer to Table 5 – Wire Size to determine the proper gauge of wire to use for power and ground.

If powering the controller and RA400 from the same battery for runs longer than 100ft use an isolated DC-DC power supply to power the RA400 to prevent ground loops. Locate the power supply close to the battery.

Table 5 – Wire Size

Length, m (ft)	Wire Gauge
0-137 (0-450)	22
137-213 (450-700)	20
213-343 (700-1125)	18
343-549 (1124-1800)	16
549-853 (1800-2800)	14

2.5.5 GSC400/TG410 Front Panel Configuration

GSC400 Firmware Note: The GSC400 must have firmware version 2.00 or higher. Version 2.03 or higher is preferred. To determine the firmware version cycle power to the GSC400 and observed the screen. The hardware and firmware versions will display for a few seconds before the GSC400 goes into the OFF or AUTO mode.

For firmware version 2.00 the default are address = 1 and baud rate = 57600. For firmware version 2.03 or greater the default is address = 1 and baud rate = 9600.

This section assumes the front panel menu is being used. The PC Interface can also be used to configure the controller.

1. Modbus BAUD rate – The RA400 can only support 9600 (default) and 19200. Set the BAUD rate in the **GSC400:** *Advanced Menu>Set Modbus>Baud Rate* or **TG410:** Communications > Modbus > Baud Rate.

2. Modbus Device ID – The RA400 can support slave address in the range of 1 (default) to 63 except addresses 2 to 4 which are reserved for slave RA400 units. Set the address to the desired value in the **GSC400:** *Advanced*

Menu>Set Modbus>Device Address or **TG410:** Communications > Modbus > Device Address.

2.5.6 RA400 Configuration

After making changes to the configuration switch located on the back of the RA400 you must cycle the power to the RA400.
Power off the RA400, wait one second, and then power on the RA400.

The RA400 can operate as either a master or slave device. **If the GSC400/TG410 is the only other device on the network you need to configure the RA400 as a master.** If you wish to have multiple RA400s on the same network configure one as a master and the others (up to three) as slaves. The three slaves must have a Modbus address of 2, 3, or 4.

If you have another device other than the RA400 as a master, that device must request all required Modbus registers from the GSC400/TG410 and send them to the RA400 unit(s). See the appendix for the Modbus registers.

Follow the instructions below to configure each RA400.

RA400 Master Mode

Ensure there are no devices using address 2, 3, or 4 except RA400 slaves. The RA400 master unit reserves these for slave RA400s. Placing other devices at these addresses can cause unexpected results, possible damage to equipment and/or harm to personnel.

With the RA400 in master mode, it will send requests to the controller. The RA400 will then turn on or off its indicators and buzzer as required. It will also send the data to addresses 2, 3, and 4 for the RA400 slaves to use.

1. Set switch 1 of SW2 to the OFF position to set RA400 as master.
2. Set switch 2 of SW2 to either the OFF position for 9600BPS or to the ON position for 19200BPS. This should match what was set in the GSC400 front panel menu and those of the slaves.
3. On SW2 set DIP switches 3 to 8 to set the Modbus device ID (Modbus address) of the controller. This should match what was set in the GSC400 front panel menu.

RA400 Slave Mode

1. Set switch 1 of SW2 to the ON position to set RA400 as slave.
2. Set switch 2 of SW2 to either the OFF position for 9600BPS or to the ON position for 19200BPS.
3. On SW2 set DIP switches 3 to 8 to set the Modbus device ID (Modbus address) of the slave RA400.

Final Setup

1. Reset power to the RA400 by unplugging the three-pin screw-terminal connector, wait one to two seconds and plug in the connector again. **OR** Press the push button on the back of the RA400 (not the button on the front).

2. The RA400 should go through a lamp test (red flash, then green flash) and sound the buzzer. If this does not occur the unit may be defective. Contact DynaGen for further information.

3. The ***Communication Status*** indicator should be green. This indicates that the RA400 has established or is trying to establish communications with the controller. **Wait for 8 seconds after power up to ensure communication is established.**

If the Communication Status LED is flashing red then the RA400 could not establish communications with the controller. Try the following:

1. If using the Dynagen supplied harness connect the RA400 directly to the end of the harness. If the RA400 works in this case then it may be a wiring issue.
2. GSC400 only: Check the firmware version on the GSC400. Requires firmware version 2.00 or latter. RA400 will communicate with GSC400 with firmware version 1.38 or latter but not all lamp indications will work or work properly.
3. Ensure that the Modbus A and B connections are not reversed on the controller and RA400. Ensure that the Modbus ground is connected.
4. Ensure the BAUD rate is the same on all slaves and master RA400 units and in the controller front panel menu.
5. If the RA400 is a slave, ensure that the Modbus device address is set to an address of 2, 3, or 4.
6. If the RA400 is a master, ensure the controller device address (switches 3 to 8) on the master RA400 is set correctly and that it matches that in the front panel of the controller.

3. RA400 Operation

This section explains the operation of the RA400 from a day to day user perspective.

3.1 Power-up

On power-up, the annunciator will emit a short beep from the buzzer, and then enter a lamp test. During the lamp test, all red LEDs will be on for 2 seconds, and then all green LEDs will be on for 2 seconds. Note that the amber color is produced by a combination of the green and red LEDs.

After lamp test concludes, all of the front panel LED indicators will turn OFF. The Communication Status LED indicator will then turn green and the annunciator panel will attempt to establish communication. If communication is unsuccessful, after approximately 7-8 seconds the Communication Status indicator will flash red and the buzzer will sound.

3.2 Reset and Low Power Behavior

If the voltage powering the RA400 drops below 6V the microcontroller on the RA400 will reset but the LED drivers which control the LEDs may not. To the user it would appear that the RA400 is operational when it is in fact not.

Once the voltage rises to 6V again the RA400 will perform an LED test and sound the buzzer as it normally does when power is applied.

3.3 Communication Status

In master mode after 7.5s of no communication with the GSC400, the RA400 will sound the alarm, turn off all LED indicators, and turn the “Communication Status” LED indicator flashing red.

3.4 Determining Controller Mode from the RA400

The GSC400/TG410 controller has three main modes of operation: OFF, AUTO, and RUNNINNG. You can tell what mode the controller is in using the ***Not In Auto*** and ***Generator Running*** Indicators on the RA400.

OFF Mode – The ***Not In Auto*** Indicator will be red and the alarm will sound unless it was silenced.

AUTO Mode – The ***Not In Auto*** indicator will be green and the ***Generator Running*** Indicator will be off.

Generator is in delay to start, preheating, cranking, and crank rest – The ***Generator Running*** Indicator will be flashing green.

RUNNING Mode – The "Generator Running" Indicator will be green.

3.5 RA400 LED Status Indicators

The RA400 Indicators will gradually dim when temperature rises above 30^{0}C (86^{0}F) to protect the indicators and prolong their life. This will not be noticeable unless the ambient temperate is very high.

The master RA400 continuously requests data from the controller and sends updates to the slave RA400 units in addition to updating its own indicators. The RA400 units should respond within **two to three seconds** of a change in controller status.

If using a DynaLink device it could take up to 30 seconds for the RA400 units to update after a change in the controller status especially if a user is viewing data from the DynaLink device on a web browser.

The DynaLink device is purchased separately and allows the user the ability to monitor controller data over Ethernet or dial-up. Refer to the DynaLink user manual for more information.

LED indicators will be illuminated on the RA400 depending upon the condition of the slave controller. The colors of the LED indicators represent the following unless otherwise specified:

Green
- Represents Normal/Active Conditions

Amber
- Represents Warning Conditions

Red
- Represents Failure Conditions

A **lamp test** can be performed by holding down the "Alarm Silence" button for a period of 3 seconds. During the lamp test, all red LEDs will turn on for 2

seconds, followed by all green LEDs for 2 seconds. Note that the amber color is produced by a combination of the green and red LEDs.

Table 6 lists the LED indicators on the RA400, their definition, and colors.

Table 6 – Front Panel LED Indicators

LED Description	Horn	LED Status / Description
Over Crank	ON	**Solid Red** - Failure condition on the final crank attempt. **Solid Amber -** Warning condition which occurs after the first unsuccessful starting attempt when there are crank attempts still remaining.
Over Speed	ON	**Solid Red / Solid Amber** - Failure / Warning condition.
Emergency Stop	ON	**Solid Red** - Emergency Stop Active.
High Engine Temperature	ON	**Solid Red / Solid Amber** - Failure / Warning condition. Also used to indicate High Engine Temperature Shorted or Open warning/failure.
Low Oil Pressure	ON	**Solid Red / Solid Amber** - Failure / Warning condition.
Low Coolant Level (Aux)	ON	**Solid Red** - Failure condition.
Low Coolant Temperature	ON	**Solid Amber** - Warning condition. Note: This is called Low Engine Temperature on the controller.
Low Fuel Level	ON	**Solid Red / Solid Amber** - Failure / Warning condition.
Communication Status	ON OFF	**Flashing Red** - no communication with GSC400 (takes up to 8 seconds to transition from green to red). **Solid Green** - communication with the controller is ok
Not In Auto	ON OFF	**Solid Red** - Controller is in the OFF mode. Automatic start is disabled. **Solid Green** – Controller is in the AUTO mode.
High Battery Volts	ON/OFF	**Solid Red / Solid Amber** - Failure / Warning condition.
Low Battery Volts	ON/OFF	**Solid Red / Solid Amber** - Failure / Warning condition.
Common Fault	OFF ON ON	**Flashing Amber** – Event condition. **Solid Amber** – Warning condition. **Solid Red** – Failure condition. For the **GSC400** this indicator uses Common Fault 1.

		For the **TG410** this indicator uses Modbus > Common 1 Events. Refer to the controller manual for how to configure these.
Low Cranking Volts	OFF	**Solid Amber** – Warning condition. Uses the low voltage during cranking setting located in the engine logic menu.
Battery Charge Failure	ON	**Solid Red** - Failure condition. Battery Charge Failure is lit if either or both of the controller ***Charger 1 Fault*** or ***Charger 2 Fault*** configurable switched input features are active.
Configurable Indicator 1	ON OFF	**Solid Red –** Failure condition **Solid Amber –** Warning condition ***Configurable Indicator 1*** uses the ***Config Warn 1*** and ***Config Fail 1*** configurable switched inputs. ***Configurable Indicator 2*** uses the controller ***Config Warn 2*** and ***Config Fail 2*** configurable switched inputs. Configurable Indicators 1 and 2 each have a white area on the label for writing the desired text. Configurable Indicator 1 is above Configurable Indicator 2. Use any permanent marker with an ultra fine tip or a fine tip.
Configurable Indicator 2		
System Ready	OFF	**Solid Green / Solid Red** – System Ready / System Not Ready. System Ready is defined as in Auto and no warnings or failures.
Generator Running	OFF	**Flashing Green –** Generator is preparing to run. **Solid Green** – Generator is running.
EPS Supplying Load	OFF	**Solid Green** – EPS is supplying load (AC current is at least 5% of the over current warning).

3.6 Alarm (Buzzer) and Alarm Silence

The alarm may sound when one or more of the LED indictors are lit. Refer to Table 6 to determine under which events the alarm will be triggered. The alarm will remain on until the indicator or indictors that caused the alarm are deactivated or the Alarm Silence button is pressed.

To re-activate the alarm (assuming that the event that caused the alarm is still active) press and hold the “Alarm Silence” button for 3 seconds until a lamp test is performed. After the lamp test the alarm will sound.

3.7 Digital Inputs 1 and 2

The digital inputs on the RA400 have the following functionality:

Note: only a master RA400 unit has the following functionality. The digital inputs on slave RA400 units are ignored.

If a local start was performed (Run button pressed on the controller) then the generator can only be shut down by triggering a System Disable command from the RA400.

1. <u>If Digital Input 1 is triggered (System Disable / System Enable).</u>

   If controller is in any mode except OFF (System Disable) – will place the controller in the OFF mode. If the controller is running, the controller will shut down normally except it will cancel any cool down period if cool down is enabled.

   If controller is in OFF mode (System Enable) – will place the controller in the AUTO mode.

2. <u>If Digital Input 2 is triggered (Start / Stop).</u>

   If controller is in AUTO mode (Start) – will start the generator.

   If controller is in RUNNING mode (Stop) – will stop the generator. This includes going through any cool down period if enabled.

   Activating digital input 2 in any other state other than RUNNING and AUTO will have no effect.

Only one digital input can be activated at any one time. Each digital input must be active for at least 0.5 seconds before the functionality outlined above is triggered. After a trigger, neither digital input can be triggered again for at least 0.5 seconds. These features are to prevent accidental triggering. **There may be a delay between input activation and the resulting controller action because the RA400 must communicate the action to the controller.**

A digital input is triggered by applying 5V or greater between its power and ground connections.

4. Recommended Maintenance

The actions in Table 7 should be performed routinely.

Table 7 – Recommended Maintenance

Procedure	Action
Inspect annunciator mounting location for possible safety issues	Inspect mounting location for any safety or fire issues. Inspect for dirt, wiring damage and mechanical damages.
Inspect annunciator for loose fasteners, terminals and wiring connections.	Check all hardware including annunciator wiring, terminals etc. for any looseness due to vibrations etc.
Clean area around annunciator	Periodically inspect and remove any debris/dirt from within or near the annunicator.
Check for any overheating due to loose connections	Check for any discoloration, melting or blistering of any wiring or connections
Perform regular testing of annunciator	Perform regular testing of the annunciator to check for proper operation.

5. Upgrading RA400 Firmware

DynaGen may, from time to time, change the software on the RA400 (i.e. firmware) to fix bugs, improve performance, or add features. The RA400 provides the user with the capability of easily upgrading the firmware with a DB9 serial cable.

Follow the below steps to load new firmware on the RA400. You will need the HC08SPRG.exe program.

It is recommended that once the software has been updated that the software revision be marked on the RA400 for future reference.

1. Remove power from the RA400.
   a) Connect one end of the DB9 serial cable with DB9 COM port to the PC
   b) Connect the other end of the cable to the DP9 RS232 connector on the RA400.
   c) Move the jumper on J2 over to the left side as outlined by the red circle in the figure below if its not already there.

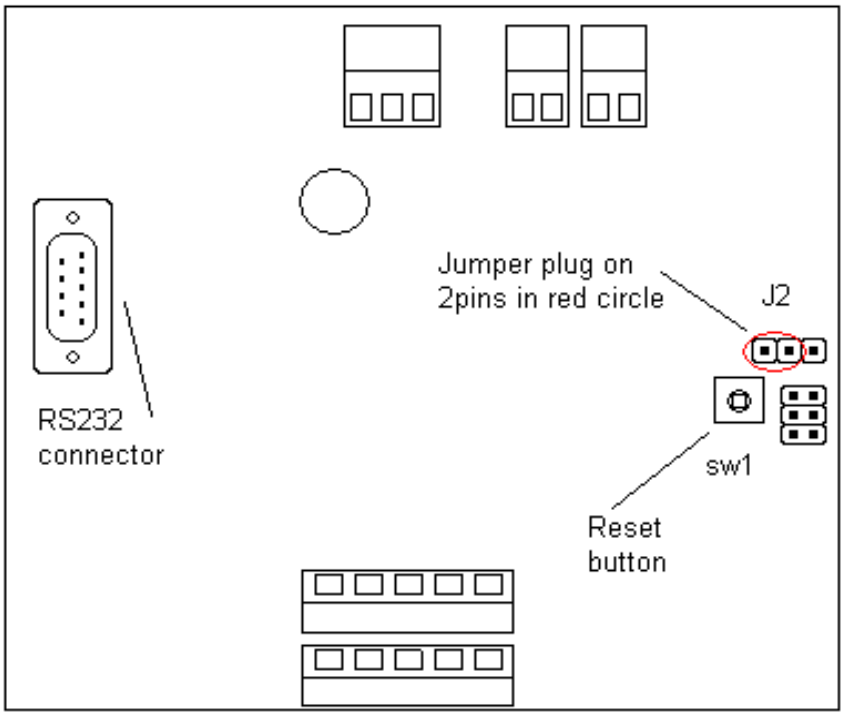


Figure 6 – Reset switch and jumper location.

2. Place the firmware file (will have file extension .S19) and hc08sprg.exe in the same directory.

3. Check which COM port the cable is plugged into on your computer, the HC08SPRG.exe program will need the COM port number of the PC. If you are using a serial to USB adapter follow these steps (this is for Windows XP):
   a) Right click on my computer in the start menu and click properties. The "System Properties" Window will open.
   b) Click on the "Device Manager" button. Another window, called "Device Manager" will open.
   c) Scroll down the window to "Ports (COM & LPT)" If you do not see this, make sure the USB adapter is plugged in and that the driver was installed. This option will not show if there are no COM ports on your computer and the USB to serial adapter is not detected.
   d) Click on the "plus" sign next to the "Ports (COM & LPT)". You should see the COM port that your adapter uses appear. This is the COM port you will use below.

4. Use the PC "command prompt" mode (In WINDOWS XP start menu, run "CMD", the PC will open a "command prompt" window, also known as DOS).

5. You will need to either store the two files (see step 1) in the ***current directory*** or use ***CHDIR*** to change the current directory to the directory folder containing these two files. In the figure below the current directory is "C:\Documents and Settings\wmanning".

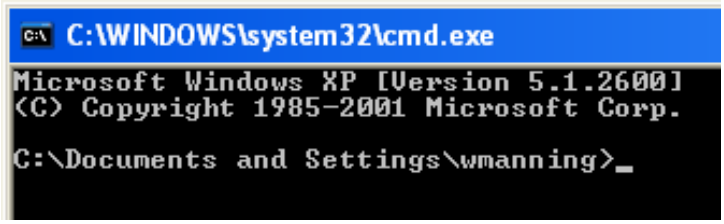


Figure 7 – DOS screen

To use CHDIR to change the current directory, type CHDIR and then one space and then the file directory enclosed in quotations. In the figure below the current directory was changed from "C:\Documents and Settings\wmanning" to "C:\Documents and Settings\wmanning\Desktop".

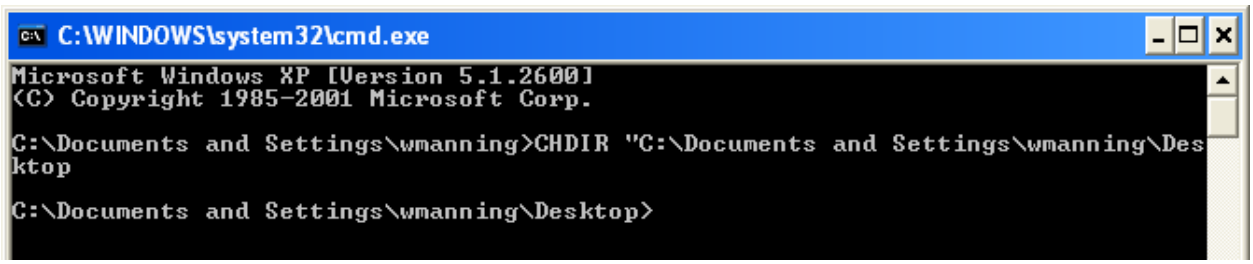


Figure 8 – DOS CHDIR command

6. Once you are in the directory that the files were placed, type the command

hc08sprg 1:D 9600 xxx.s19

where:

a) The “1” refers to the COM port of the computer where you obtained in step 3 above.
b) The 9600 is the BAUD rate of the RA400. Ensure that switch 2 of the 8 position DIP switch ***SW2*** on the RA400 (see Table 2 on page 12) is in the OFF position.
c) The “xxx” of “xxx.s19” is the name of the firmware .s19 file you have.

7. Press enter. You will see the following info appear if you entered everything correctly. Note: The numbers may not be the same.

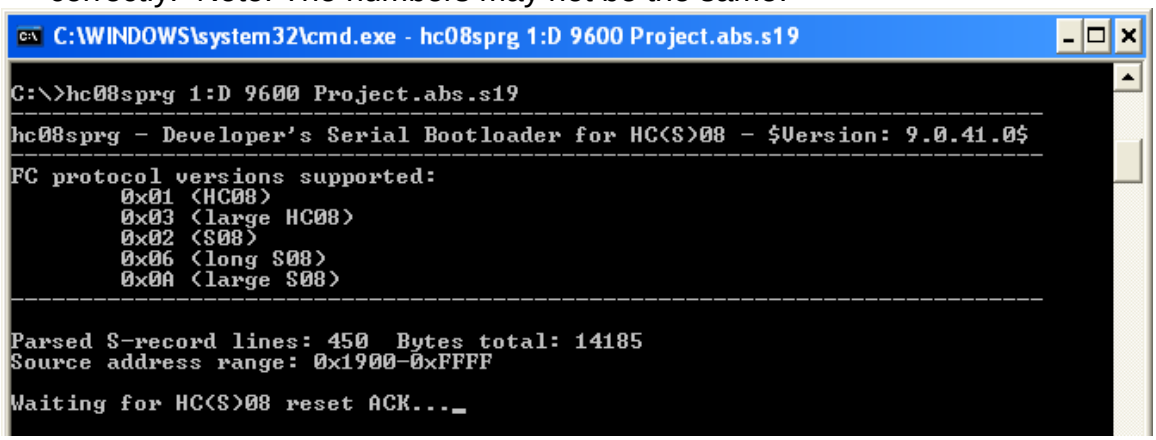


Figure 9 – Valid command response

Otherwise you will see this info.

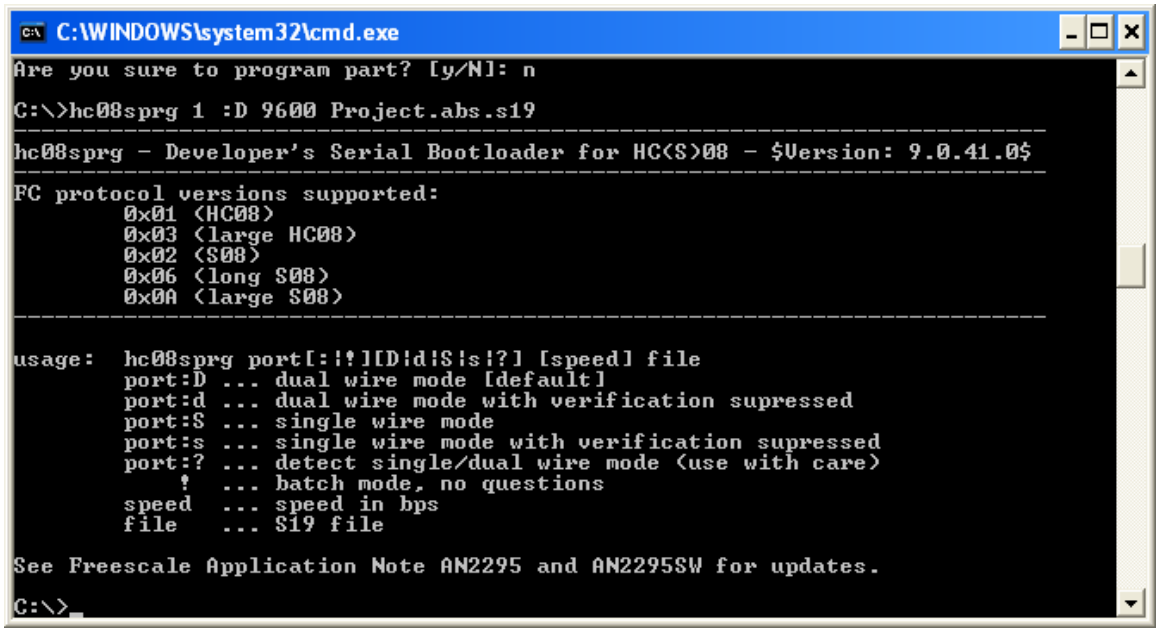


Figure 10 – Invalid command response

8. Power on the RA400. You will see the following info appear (numbers shown may not be the same).

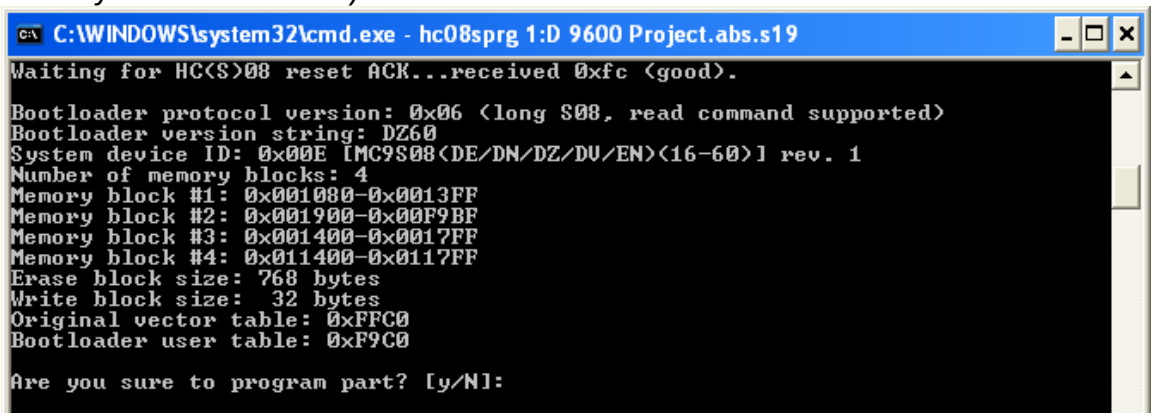


Figure 11 – Program part prompt.

9. Type “y” if you want to start programming or type “n” if you want to cancel. Then presses the “ENTER” key; the firmware will start to load. A new line will appear with the percent of memory programmed so far. When this reaches 100% the programmer is finished.

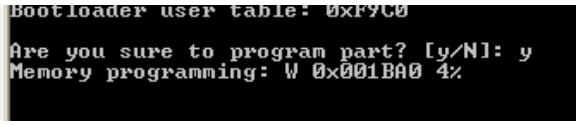


Figure 12 – Programmer status.

10. The program will verify that the memory has been programmed properly. It should say OK next to “Memory verified”. If it does not, try programming again.

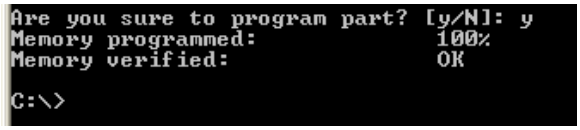


Figure 13 – Programmer ok.

Appendix A Troubleshooting

1. The RA400 appears to be operational (indicators are lit) but does not respond.

   Check that the voltage to the RA400 power inputs is 6V or above. Voltages between 4.5V and 6V may cause the computer on the RA400 to reset but not the drivers controlling the LED indicators. This has the effect of making the RA400 appear operational, when in fact it is not.

2. The RA400 LED Indicators appear dimmer than usual.

   The RA400 LED feature protection which decreases the current to the LED indicators with increase in ambient temperature. This protects the LED and increases its life. The user should not notice the indicators diming until the temperature is above 40^0C to 50^0C.

   If the LEDs are dimmer than usual there could be a problem causing heat buildup behind the RA400. Remove the RA400 and check all connections. If it continues the RA400 could be defective.

3. The RA400 appears dead. No indicators are on.

   (1) Confirm that power and ground are connected properly. Measure on the three pin power terminal to ensure at least 6VDC is at the terminal in the proper polarity. Refer to Figure 3 – RA400 terminals as seen from the rear. on page 10.

   (2) Press and hold the ***Alarm Silence*** button for 3-4 seconds. Does the RA400 perform a lamp test? The indicators should flash green and then red. If none of them flash or only some of them you may have a defective unit. Contact DynaGen Technical Support for further information.

4. The Communication Status LED is flashing red.

   (1) GSC400 only: Check that the firmware in the GSC400 is 2.00 or greater. To do this cycle the power to the GSC400 and observe the firmware version on power up.

   (2) Ensure that you have the modbus A, B, and ground connections to the controller and RA400 correct. As a quick test try reversing the A and B leads on the RA400 side. In addition make sure there is a ground wire from the controller modbus connector to the RA400 modbus common terminal.

(3) Check the baud rate in the controller front panel menu system and confirm that the DIP switch on the RA400 is set to the correct BAUD rate. The RA400 can only operate on two BAUD rates: 9600 and 19200. Refer to Table 2 – RA400 DIP Switch on page 12 for the switch position meaning.

(4) Check that the RA400 is set to a master. If you are using the DynaLink WS100/WS200 device on the same modbus network, then the RA400 must be set as a slave and refer to the DynaLink user manual for more information.

(5) Check that switches 3 to 8 are set correctly on the RA400 to give the desired device ID. Check that the controller Device ID match that switches 3 to 8 on the RA400. Refer to Table 3 – Device ID DIP Switch Position on page 12 to determine the meaning of the DIP switches.

3. The Genset is starting but the "Generator Running" Indicator on the RA400 is not flashing green.

   GSC400 only: Check that the firmware in the GSC400 is 2.00 or greater. To do this cycle the power to the GSC400 and observe the firmware version on power up.

   On the RA400 the **Generator Running LED** will **flash green** to indicate that the genset is starting up (delay to start, cranking, crank rest, etc). If you are using a DynaLink device the delay between the controller action and the corresponding RA400 annunciation of that action is much longer than using an RA400 as a master.

   Maximum Response Times:
   1. RA400 master: **2-3s**
   2. WS100/WS200 as master with 1 RA400: **5s**
   3. WS100/WS200 as master with 4 RA400: **30s**

5. GSC400 only: The ***Common Fault*** Indicator is not turning on even though I selected my Failures/Warnings/Events in the ***Advanced>Common Faults*** menu on the GSC400 front panel and one or more of my Failure/Warning/Event I selected is active on the GSC400. Communications are fine (***Communication Status*** Indicator is green).

   (1) The Common Fault Indicator uses the ***Common Fault 1*** feature of the GSC400. Ensure that you set your Failures/Warnings/Events using "***Failure Table 1***", "***Warning Table 1***", and "***Events Table 1***" menus located under the Common Faults menu in the ***Advanced*** menu of the GSC400 front panel menu system.

(2) Additionally settings may have been changed with the PC Interface. Open the GSC400 PC Interface and go to the ***Faults*** tab under the ***GSC400 Update*** tab. Click the ***Read Faults*** button at the bottom to get the information from the GSC400. Under the ***Common 1*** tab, the Common Faults, Common Warnings, and Common Events should all be selected in the Modbus box.

The ones not selected will not be sent over modbus to the RA400. The purpose of the Modbus selection is to allow control over which event type to display locally and which type to send remotely over modbus. They all are selected by default from the factory and can only be changed from the PC Interface.

Appendix B Modbus Map

These are the registers that the RA400 reads from the GSC400 and TG410. There are also the internal registers of the RA400 itself. The RA400 interprets the data given in its registers to determine how to control the lights and horn.

Table 8 – Modbus Register Map

Register	Parameter	Description
40001 ~ 40002	Reserved	
40003 ~ 40009 (Read Only)	Each event uses 5bits b4, b3, b2, b1, b0 where b0 is the least significant bit. b0 = The event status (warning or shutdown occurring) 0 = Not Active, 1 = Active b2-b1 = The severity of the event 0 = Take No Action, 1 = Warning/Acknowledge 2 = Action Required, 3 = Take Immediate Action (shutdown) b3 = Alarm Action (indicates if GSC400 is sounding buzzer) 0 = No Audible Alarm, 1 = Sound Audible Alarm b4 = Warning/Failure Feature Enabled/Disabled 0 = Disabled, 1 = Enabled The follow conditions will turn off the corresponding LED indicator (unless otherwise stated below): 1. BIT b0, event status, OR BIT b4, feature enabled/disabled, are equal to 0 2. Bits b2-b1, severity, is 0 Bit b3 controls whether the buzzer (audible alarm) sounds, unless otherwise stated below, assuming bits b0 and b4 are set, and the b1-2 are not cleared.	
40003	bits 4-0 **System Ready Indicator** (red if event status cleared, green is event set) bits 9-5 **Reserved** bits 14-10 **High Engine Temperature Indicator** (amber if severity set to 1, red if severity set to 3, off otherwise)	
40004	bits 4-0 **Low Oil Pressure Indicator** (amber if severity set to 1, red if severity set to 3, off otherwise) bits 9-5 **Overspeed Indicator** (amber if severity set to 1, red if severity set to 3, off otherwise) bits 14-10 **Emergency Stop Indicator** (red if severity set to 3, off otherwise)	
40005	bit 4-0 **Low Coolant Level/Aux Indicator** (red if severity set to 3, off otherwise) bits 9-5 **Low Coolant Temperature Indicator** (amber if severity set to 3, off otherwise)	

	bits 14-10 **Low Fuel Level Indicator** (amber if severity set to 1, red if severity set to 3, off otherwise)	
40006	bits 4-0 **Reserved** bits 9-5 **EPS Supplying Load Indicator** (green if event status is set, off otherwise) bits 14-10 **Reserved**	
40007	bits 4-0 **Not In Auto Mode Indicator** (green if event status is cleared, red if severity is 3, off otherwise; event status has priority over the severity) bits 9-5 **Battery Charger Failure Indicator** (red if severity is 3, off otherwise) bits 14-10 **Low Battery Volts Indicator** (check register 40085 first; amber if severity of 1, otherwise off)	
40008	bits 4-0 **High Battery Volts Indicator** (check register 40085 first; amber if severity of 1, otherwise off) bits 9-5 **Low Cranking Volts Indicator** (amber if severity is 1, off otherwise) bits 14-10 **Reserved**	
40009	bits 4-0 **Common Fault Indicator** (flashing amber if severity is 1, amber if severity is 2, red if severity is 3, off otherwise) bits 14-5 **Reserved**	
40010 ~ 40079	Reserved	
40080	Overcrank Indicator (GSC400 Front Panel LED Status)	If Bit 0 is set Red LED turns on regardless of Bit 1, else if Bit 1 is set Amber LED turns on, else LED turns OFF if both bits are cleared.
40081 ~40083	Reserved	
40084	bits 9 and 11 **Configurable Indicator 1** (amber if bit 9 set [no audible alarm], red if bit 11 set [audible alarm], off otherwise. If bit 11 is set status of bit 9 should be ignored.) bits 10 and 12 **Configurable Indicator 2** (amber if bit 10 set [no audible alarm], red if bit 12 set [audible alarm], off otherwise. If bit 12 is set status of bit 10 should be ignored.) Configurable Indicators 1 and 2 each have a white area on the label for writing the desired text. Configurable Indicator 1 is above Configurable Indicator 2.	
40085	High/Low Battery Volts Failure Indicator Override	If bit9 is set, Low Battery Volts Indicator is red. If bit9 is cleared read register 40007 to determine if indicator should be amber or off. If bit 10 is set, High Battery Volts Indicator is red. If bit9 is

		cleared, read register 40008 to determine if indicator should be amber or off.
40086 ~ 40099	Reserved	
40100 ~ 40101	Generator Running Indicator	1. If register 40100 is not equal to 0x9C Indicator is off. 2. If register 40100 = 0x9C and register 40101 = 19, 20, 21, or 23 Indicator is flashing green (preparing to start). 3. If register 40100 = 0x9C and register 40101 is not equal to 19, 20, 21, or 23 Indicator is green.

Appendix C Drawings / Specs

The following pages contain various drawings that may be useful.

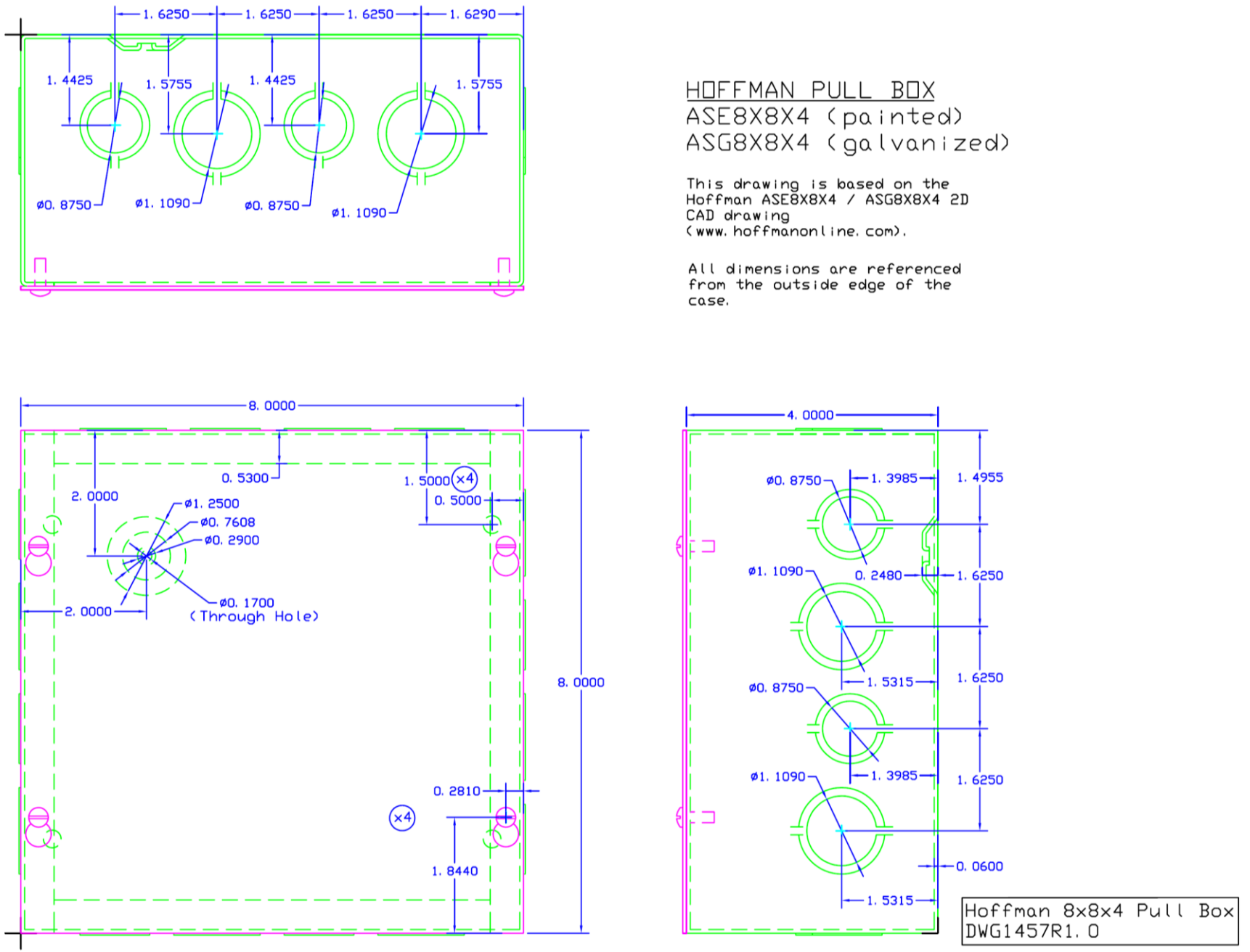
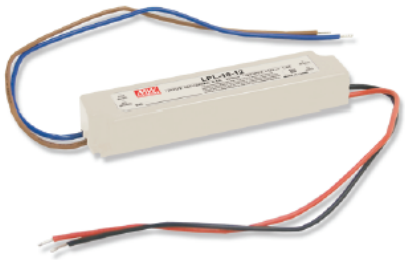


Figure 14 – Hoffman 8x8x4Pull B

JAMECO ELECTRONICS **Jameco SKU Number: 2101059**

MEAN WELL

18W Single Output Switching Power Supply **LPL-18 series**



■ Features :

- 90-132VAC input only
- Fully encapsulated with IP67 level
- Protections:Short circuit/Over load/Over voltage/Over temperature
- Cooling by free air convection
- Pass LPS
- 100% full load burn-in test
- Suitable for LED lighting and moving sign applications
- High reliability/Low cost
- 2 years warranty

SPECIFICATION LPS IP67 FC CE (LVD)

MODEL		LPL-18-12	LPL-18-24	LPL-18-36
OUTPUT	DC VOLTAGE	12V	24V	36V
	RATED CURRENT	1.5A	0.75A	0.5A
	CURRENT RANGE	0 ~ 1.5A	0 ~ 0.75A	0 ~ 0.5A
	RATED POWER	18W	18W	18W
	RIPPLE & NOISE (max.) Note.2	120mVp-p	150mVp-p	200mVp-p
	VOLTAGE TOLERANCE Note.3	±3.0%		
	LINE REGULATION	±1.0%		
	LOAD REGULATION	±2.0%		
	SETUP, RISE TIME	1500ms, 30ms / 115VAC		
	HOLD UP TIME (Typ.)	20ms/115VAC at full load		
INPUT	VOLTAGE RANGE	90 ~ 132VAC		
	FREQUENCY RANGE	47 ~ 63Hz		
	EFFICIENCY(Typ.)	80%	83%	84%
	AC CURRENT	0.5A/115VAC		
	INRUSH CURRENT(max.)	Cold start 40A/115VAC		
	LEAKAGE CURRENT	0.25mA / 115VAC		
PROTECTION	OVER CURRENT	Above 105% rated output power		
		Protection type : Hiccup mode, recovers automatically after fault condition is removed		
	OVER VOLTAGE	13.8~ 16.2V	27.6~ 32.4V	41.4 ~ 48.6V
		Protection type : Shut off o/p voltage, clamping by zener diode		
	OVER TEMPERATURE	Tj 140℃ typically (U1) detect on main control IC		
		Protection type :Shut down, recovers automatically after temperature goes down		
ENVIRONMENT	WORKING TEMP.	-30 ~ 70℃ (Refer to output load derating curve)		
	WORKING HUMIDITY	20 ~ 90% RH non-condensing		
	STORAGE TEMP., HUMIDITY	-40 ~ +80℃, 10 ~ 95% RH		
	TEMP. COEFFICIENT	±0.03%/℃ (0 ~ 50℃)		
	VIBRATION	10 ~ 500Hz, 2G 10min./1cycle, period for 60min. each along X, Y, Z axes		
SAFETY & EMC	SAFETY STANDARDS	Design refer to UL1310 Class 2,TUV EN60950-1, EN61347-2-13, CAN/CSA C22.2 No. 223-M91, IP67 approved		
	WITHSTAND VOLTAGE	I/P-O/P:3KVAC		
	ISOLATION RESISTANCE	I/P-O/P:>100M Ohms / 500VDC / 25℃/ 70% RH		
	EMI CONDUCTION & RADIATION	Compliance to EN55022 (CISPR22) Class B, FCC Part 15		
	HARMONIC CURRENT	Compliance to EN61000-3-2,-3		
	EMS IMMUNITY	Compliance to EN61000-4-2,3,4,5,6,8,11; ENV50204, EN55024, light industry level, criteria A		
OTHERS	MTBF	1207.4Khrs min. MIL-HDBK-217F(25℃)		
	DIMENSION	140*30*20(L*W*H)		
	PACKING	0.175Kg; 70pcs/13.3Kgs/0.66CUFT		
NOTE	1. All parameters NOT specially mentioned are measured at 115VAC input, rated load and 25℃ of ambient temperature. 2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capacitor. 3. Tolerance : includes set up tolerance, line regulation and load regulation. 4. The power supply is considered a component which will be installed a final equipment.The final equipment must be re-confirmed that it still meets EMC directive			

Figure 15 – Page 1 of ACC0120 datasheet. Model number is LPL-18-12. Taken from http://www.jameco.com.

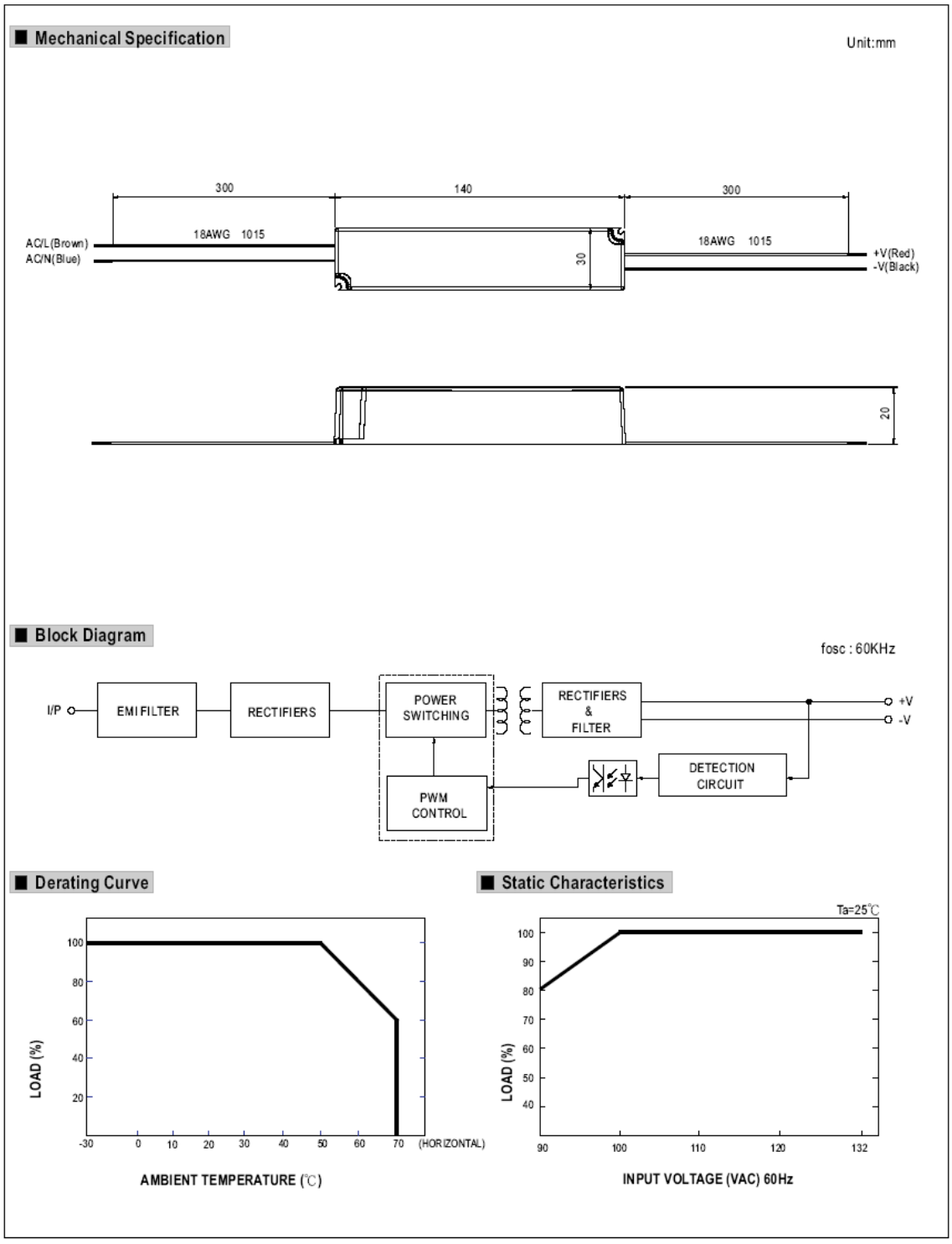


Figure 16 – Page 2 of ACC0120 datasheet. Taken from http://www.jameco.com.