TECHNICAL MANUAL

Pow-R-Con™

MODELS:

DYN2-94025 (Pow-R-Con™ with Keypad/Display Panel mounted in cover)

DYN2-94026 (Pow-R-Con™ without Keypad/Display Panel)

DYNK-55100 (Keypad/Display Panel only)

DYNA-29900 (Pow-R-Con™ with Keypad/Display Panel for remote mounting)

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1.0 INTRODUCTION

1.1 GENERAL

The Barber-Colman Pow-R-Con™ provides integrated, multi-function control and monitoring of single or multiple generator units. The following features are available with a Pow-R-Con™ module interfaced to an engine/generator:

- Measurement, Annunciation, and Control Setup
- Isochronous Load Sharing
- Auto-Synchronizing
- Load Commanding/Blending

Programming and monitoring of all operational functions are available to the user through either a dedicated Keypad/Display Panel or by connecting a laptop computer to the Pow-R-Con™ .

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1.2 Pow-R-Con™ PART NUMBERS

- DYN2-94025 (with Keypad/Display Panel mounted in cover)
- DYNA-94026 (without Keypad/Display Panel)
- DYNK-55100 (Keypad/Display Panel only)
- DYNA-29900 Pow-R-Con™ with Keypad/Display Panel for remote mounting

1.3 STANDARD FUNCTIONS

The Pow-R-Con™ is used for digital synchronizing, soft loading/unloading, load sharing and power measurement of 50 and 60 Hz generators. State-of-the-art technology is provided in a self-contained module with easy field wiring. A 16-bit microcontroller is used for phase, frequency, voltage match, digital setup, and power measurement. Parameters are monitored, and setup performed by means of a backlit Keypad/Display Panel which may be mounted integral to the Pow-R-Con™ or be configured in a remote mounting. RS-485 terminals are provided for connecting to a PC for monitoring, adjusting, and setup.

1.3.1 DISPLAY AND PROGRAMMING

Two (2) models of the Pow-R-Con™ are available to permit a variety of user monitoring and editing configurations. Model DYN2-94025 is provided with an integral Keypad/Display Panel, flush-mounted on the front of the Pow-R-Con™ . Model DYN2-94026 is offered without a Keypad/Display Panel and is intended to be used in conjunction with the user's laptop PC, and Barber-Colman Protocol Software. (Model DYNA-29900 is a DYNA 94026 Pow-R-Con™ and a separate DYNK-55100 Keypad/Display Panel for Remote Mounting). The Pow-R-Con™ is provided with RS-485 terminals to connect to the PC for monitoring, adjusting, and setup.

The following additional functions are accessible with each Pow-R-Con™ :

- Selectable nominal input voltage from 120 to 480 VAC and frequency from 50/60 Hz.
- Digital "true rms" readouts of currents/voltages, real/reactive power and power factor for each phase, and total real power, average power factor and frequency for three-phase.
- Status indication of major outputs and inputs with LED's.
- Synchroscope on the LCD display during synchronization.

1.3.2 ISOCHRONOUS LOAD SHARING

The object of isochronous load sharing is to proportionally divide a common load between two or more engine/generator sets while maintaining a fixed frequency. Each Pow-R-Con™ compares the load of its generator unit with the load applied to all other units in operation, through the paralleling lines, and either decreases or increases the engine fuel to maintain its proportional share of the total load.

1.3.3 AUTO-SYNCHRONIZING

Auto-Synchronizing is used in prime power installations, standby power installations and other situations where it is desirable to parallel an engine/generator. The Pow-R-Con™ incorporates automatic synchronizing to match the frequency and phase of an incoming generator to the frequency and phase of either the bus, the utility or another generator. The synchronizer compares the incoming generator to the frequency and phase to be matched and controls its speed and phase to assure synchronization within a minimum of time.

1.3.4 LOAD COMMANDING/BLENDING

Blending loads with the Pow-R-Con™ allows for soft loading, unloading and power setting of the controlled generator. The following additional functions are provided:

- Adjustable ramp up and ramp down timers
- Adjustable minimum and maximum power setting
- Remote potentiometer input for setting power level

2.0 OPERATION

2.1 GENERAL

The Pow-R-Con™ is a stand-alone panel containing the micro-processor controls and field wiring terminals to connect to a generating unit. It also contains terminals for connecting it to a network of generators. The monitoring, commanding, and setup functions are performed through the use of a Keypad/Display Panel or an external laptop computer.

2.2 SYSTEM FUNCTIONS

The following procedure is used to check on or improve the performance of the Pow-R-Con™. This section is divided into four (4) functional sections:

- Isochronous Load Sharing
- Auto-Synchronizing
- Load Ramping/Blending

Prior to starting up the system, the Setup Procedure must be performed.

After the Setup Procedure has been properly completed, the engine governor must be properly calibrated.

2.2.1 ISOCHRONOUS LOAD SHARING

Isochronous Load Sharing provides the following features:

- Built-In Paralleling Relay
- Adjustable Droop
- Adjustable Forward Power On, Forward Power Off, Reverse Power Relay and LED Indication
- Forward Power On and Off Adjustable Time Delay
- Adjustable Load Pulse Sensitivity (Potentiometer)
- Remote Adjustable Governor Speed Set (potentiometer)
- Keypad Entered Full Load Bridge Voltage, PT and CT Ratios

2.2.1.1 Isochronous Configuration

Isochronous load sharing is used to proportionally divide a common load between two or more engine/generator sets while maintaining a fixed frequency. Each Pow-R-Con™ compares its generator load with the load of all other units in operation, via the paralleling lines. The parallel line voltage either decreases or increases indicating the engine's proportional share of the total load.

ILS can provide governor control in four (4) modes:

- Single unit isochronous
- Single unit droop
- Parallel unit isochronous
- Parallel unit droop

2.2.1.2 Droop Configuration

The droop configuration is necessary to limit the load carried by the engine/generator sets when paralleled with an infinite bus. The infinite bus frequency is fixed; therefore, operating isochronously will either overload the engine/generator or cause shutdown on reverse current, depending upon whether the reference speed for the engine/generator is below or above the bus frequency.

All engine/generators should be set to the same droop when connected to the bus. Once the engine/generators are paralleled in droop on an infinite bus, load is picked up by increasing the fuel on each engine/generator.

The droop mode is obtained when terminal 35 is connected to terminal 37. The amount of droop is adjustable over the range of 0 to 10% by setting the "droop" potentiometer (R146).

The Droop potentiometer should be set fully CCW when not operating in droop.

2.2.1.3 Load Pulse Calibration

The load pulse feature senses generator load changes and signals the governor to increase or decrease engine fuel before there is an actual change in engine speed. The amount of load pulse is adjustable (R148).

The load pulse potentiometer should be set fully CCW when not in use.

2.2.1.4 Load Sharing

The load sharing control computes total generator power from three phase voltage and current sensing. The generator output is compared with the level on the paralleling lines and an output is sent on the generator speed set line to allow for load sharing. The load sharing function is enabled by activating the breaker auxiliary input (closing terminal 39 to 40). A remote speed potentiometer (5K) may be connected to terminals 30, 31 and 32 to adjust the engine speed/frequency.
The real and reactive power (kW/kVAR), power factor and individual phase voltage and current magnitudes ("true rms") can be monitored through the display.

The generator rated voltage, current, and full load output in kW must be entered for proper scaling. A 4-20 mA output is provided for external monitoring of the generator output power.

A reverse power relay contact (normally open) is energized after the generator output has remained in reverse power for a predetermined time interval. An inverse time algorithm is used to calculate reverse power time delay.

A forward power on relay contact (normally open) is energized after an adjustable time for which the generator output has exceeded an adjustable forward power on level.

An additional forward power off relay contact (normally open) is energized after the generator output falls below an adjustable level after the forward power on relay has energized.

The latter two relay contacts along with the adjustable power levels and time delays can be used in a simple hardwired configuration for sequentially turning on or off individual generators in a multiple generator system as the overall load varies.

2.2.2 AUTO SYNCHRONIZING

The Auto Synchronizer provides the following features:

- Adjustable Breaker Closing Angle Window for Phase, Frequency, and Voltage Match
- Adjustable Phase and Frequency Gains
- LED Indicators for Sync Enable and Unmatched Voltage, Frequency and Phase
- Voltage Match Relay Output Control

The synchronizer monitors voltage, frequency and phase of the generator and the bus and provides a speed input to the governor to bring these parameters within the adjustable windows for synchronism. The synchronizer has a maximum capture range of ± 2.0 generator Hz. A normally open relay contact is closed for breaker control when the generator is synchronized. LED lamps are provided to indicate a voltage, frequency and phase mismatch.

2.2.2.1. Automatic

The automatic mode is enabled when the synch enable input (Terminal 38) is activated by jumpering to the COMMON -Terminal 39. In this mode the controller output -GOV SPD SET (Terminal 28) is active and the synchronizer adjusts the engine speed and voltage to bring the generator into synchronism. The breaker close output contact is energized when the voltage, phase and frequency of the generator with respect to the bus are within adjustable parameters:

In the AUTOMATIC mode the synchronizer operates as follows: As soon as the incoming generator voltage reaches approximately 50% of output voltage, the synchronizer compares its frequency to the bus. If there is a difference, the synchronizer sends a signal to the governor to bring the generator to the bus frequency. When the frequency difference is approximately ± 0.5 Hz, the phase of the generator is also compared to the bus. The synchronizer then produces a governor control signal to bring the signal within the phase differential limit. The synchronizer energizes the output contacts (terminals 21 and 22) only after the following conditions are met:

- Frequency difference within ± 0.1 to ± 0.25 Hz
- Phase difference within ± 2 to ± 20° for 50/60 Hz
- Voltage difference within ± 1 to ± 15%

The synchronizer also has voltage matching capability. The incoming generator voltage is compared to the bus voltage. Whenever the voltage difference is out of the set range, the circuit breaker contact will not close and one of the voltage matching contacts will be closed. If the generator voltage is out of the window and is lower than the bus voltage, then the up relay will be closed; if higher, the down relay will be closed. These relays can be connected to a motorized potentiometer or other device which will adjust the generator voltage up or down.

2.2.2.2 Reset

The synchronizer is in the reset mode when the SYNCH ENABLE output is not activated. In this mode, the synchronizer is still sensing the two voltage waveforms but is not controlling the outputs.

2.2.2.3 Auto Synchronizer Calibration

Auto Synchronizer performance may be checked and improved.

WARNING: PRIOR TO ACTUALLY CLOSING THE GENERATOR BREAKER TO THE BUS OR TO ANOTHER GENERATOR THOROUGHLY CHECK THAT THE PHASE ROTATION AND VOLTAGES ARE CORRECT.

For this procedure open the wires from the Auto-Synchronizer (terminals 21 and 22) to the breaker to prevent actually closing the breaker. It is recommended that a light or ohmmeter be connected to the output of the Auto-Synchronizer breaker close contacts (21 and 22) or to indicate when a closure signal is given.

To aid in checking or improving the performance of the Auto Synchronizer, a Synchroscope, dual channel recorder with two frequency (generator and bus) channels or an AC voltmeter from the same phase across the generator breaker can be used.

From the Main Menu select ENGINEERING. This will bring up a screen with "Auto sync menu." Select the Auto sync menu to bring up the Engineering Auto Sync Menu. See Section 3.0 for calibration of the auto synchronizer

2.2.3 LOAD RAMPING OPERATION

The following load ramping features are available with the Pow-R-Con™ :

- Individually Adjustable 5 Seconds to 5 minutes Up/Down Electronic Ramps
- Adjustable Low and High Power Limit
- Remote Adjustable Power Level (Keypad or Potentiometer)
- Individual Load Control
- Adjustable Breaker Trip Limit
- LED Indication -High and Low Limit, Command Mode, Blend Mode, Load Generator, Unload Generator, Breaker Trip

There are two modes of operation for the load ramping function:

- Blend (selected by closing input terminal 45 to 46).
- Command (selected by closing input terminal 47 to 48).

When neither of these inputs is selected, the load ramping function is disabled. The primary function of the load ramp is to control the output of the generator independent of the system load sharing voltage monitored on the paralleling lines, and to connect the internal (Unit) load sharing lines to the external (System) load sharing lines when the two levels are matched.

2.2.3.1 Blend Mode

In this mode the unit load sharing lines are initially disconnected from the system load sharing lines. After the generator breaker is closed, the Pow-R-Con™ holds the generator output at the low limit until a ramp up input is provided. Then the load on the generator is ramped up to the level on the system load sharing lines. When these two levels are the same, the unit load sharing lines are tied to the system load sharing lines and normal load sharing between the generators is resumed.

Conversely, if the generator was already sharing the load and a ramp down input is provided, the system and unit load sharing lines are first separated and the generator load is ramped down to the low limit. When the breaker trip level is reached, and the Breaker Trip input is active, (terminals 42 and 44 are closed). The breaker trip relay output (terminal 19 to 20) is closed to open generator breaker.

The ramp rates are adjustable from 5 seconds to 5 minutes.

See Figure 1

2.2.3.2 Command

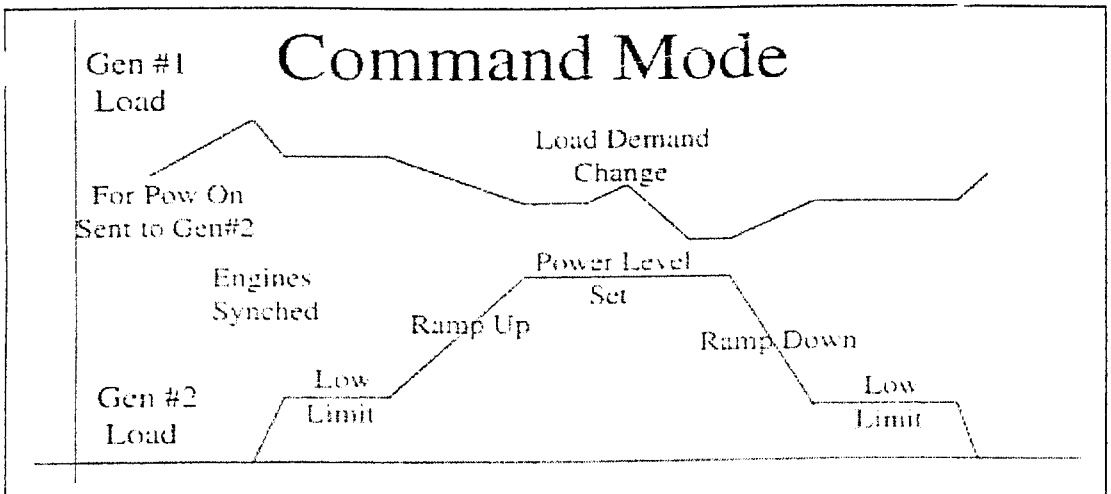
In this mode the unit load sharing lines are never connected to the system load sharing lines. After the generator breaker is closed, the Pow-R-Con™ holds the generator output at the low limit until a ramp up input is provided. Then the load on the generator is ramped up to the external power set.

Conversely, if the generator was already sharing the load and a ramp down input is provided. When the breaker trip level is reached, and the Breaker Trip input is active, (terminals 42 and 44 are closed). The breaker trip relay output (terminal 19 to 20) is closed to open generator breaker.

The ramp rates are adjustable from 5 seconds to 5 minutes.

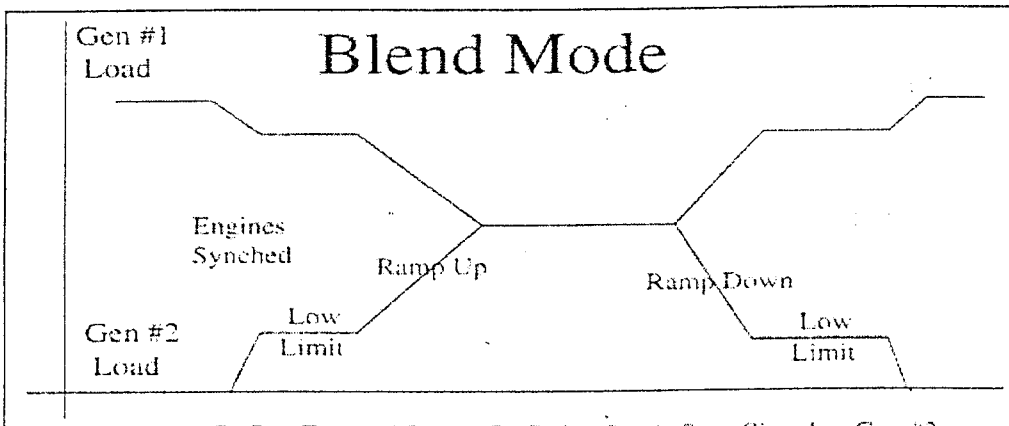
See Figure 2

FIGURE 1



1.Gen #1's Pow-R-Con Forward Power On Relay Sends Start Signal to Gen #2.
2.Gen #1's Parallel Lines are Monitored by Gen #2's Pow-R-Con (during power level mode parallel lines never connected), and Gen #2 is Synchronized.
3.Gen #2 is Loaded to the Preset Low Limit.
4.Upon Receiving Ramp Up Signal, Gen #2 is Ramped to Power Level Set.
5.Gen #2 Power is Held at Power Level Set.
6.Ramp Down Signal Given to Gen #2 and Power Level is Set to Low Limit.
7.Breaker Trip Signal Sent to Gen #2 and Engine is Taken Off Line.

FIGURE 2



1.Gen #1's Pow-R-Con Forward Power On Relay Sends Start Signal to Gen #2.
2.Gen #1's Parallel Lines are Monitored by Gen #2's Pow-R-Con and Gen #2 is Synchronized.
3.Gen #2 is Loaded to the Preset Low Limit.
4.Upon Receiving Ramp Up Signal, Gen #2 is Ramped Up Until Each Engine is Proportionally Carrying its Share of the Load.
5.The Paralleling lines are Connected, and Proportional Load Sharing Continues.
6.Gen #2 Receives a Ramp Down Signal, and the Paralleling Lines are Disconnected and Unit is Ramped Down to the Low Limit.
7.Breaker Trip Signal Sent to Gen #2 and Engine is Taken Off Line.

2.3 KEYPAD/DISPLAY PANEL

The Pow-R-Con™ unit is configured with or without a Keypad/Display Panel. An integral or remote Keypad/Display Panel is necessary, unless a laptop computer is used, for annunciation, programming, and setup. Measured parameters are computed as "true rms" quantities based on waveform sampling with a high speed 12-bit A/D convertor.

The LCD display provides an English language readout of all values and functions necessary for the command and setup of the associated generator unit. A monitoring function provides analog performance characteristics of the generator.

2.3.1 HARDWARE DESCRIPTION

The display is a 2x20 character backlit LCD and the keypad has seven (7) environment protected keys for scrolling through various menus, viewing and entering parameters. The display has four (4) modes: Monitor, Review, Program, and Setup. In the monitor mode, the display can be scrolled through screens showing phase 1-N, 2-N, 3-N, 1-2, 2-3, 3-1 and average parameters. In the review mode, all settings are displayed without being changed, and are classified under synchronizer, command, load blending and load sharing functions. In the program mode, the settings can be reviewed and changed. Setup mode is used to make initial power and CT profile entries for each associated generator. Fifteen (15) color-coded LED's are used to indicate controller and system status.

During synchronizing, the display becomes a synchroscope, with the phase difference shown as a bar graph. The bar graph is displayed when the two frequencies are close to each other, and displays as a moving character when they are further apart at the start of the synchronizing process.

The display unit is powered by a 16-30 VDC input. When located within 10 feet of the main controller the power can be obtained from the Battery +/-terminals on the main controller. For larger distances, a local DC power source may be used. The display can be mounted up to 4000 ft. away from the main controller when using proper wiring (Battery +/-twisted, RS-485 shielded).

2.3.2 KEYPAD/DISPLAY PANEL OPERATION

The following keys are provided for user monitoring and editing:

ESC -Escape key

This key is used to select Monitor, Program, Review, or Setup modes. It may be pressed to return to the previous function at any time.

SCROLL -Scroll key

From the automatic monitoring mode, pressing the left or right SCROLL key allows the desired phase-to-phase, phase-to-neutral, or average set of values to be displayed on the LCD. Press ESC to return to automatic monitoring.

Press ENTER and the display should lock on the desired phase-to-phase, phase-to-neutral, or average value. Press the ESC key twice to return display to scrolling.

In the Review, Program, or Setup modes, the Scroll key allows forward or reverse display of the various menu selections.

SELECT -Select key

Pressing the Select key places the unit in the mode or data entry point shown on the LCD display.

INCREASE / DECREASE -Increase and Decrease keys.

When a data entry is selected, the value is changed by depressing the Increase or Decrease key.

ENTER -Enter key

When a desired data entry value is displayed, pressing the ENTER key will place the value in the program.

Also, pressing ENTER during the monitor mode will stop the display from scrolling. Pressing ENTER again causes scrolling to resume.

During initial power up, the Liquid Crystal Display (LCD) on the Keypad/Display Panel displays the panel revision level, then reverts to automatically scrolling through the following measured phase-to-phase, phase-to-neutral, and average values:

- Phase (1-2, 1-N, 2-3, 2-N, 3-1, 3-N and AVG)
- Volts
- AMPS
- Hertz
- kWatt
- kVAR
- PF

From the Monitor Mode, Review Mode is entered by pressing ESC on the keypad/display panel, followed by the SELECT key. Program or Setup modes are altered by pressing either SCROLL key followed by

the SELECT key. Pressing the SCROLL key without pressing the SELECT key will loop through the three mode choices with each keystroke.

Press SCROLL to advance or reverse within the major menu item selected (eg: Sync to Command), or press ESC to return to the previous major menu item (eg: REVIEW to PROGRAM).

The modes from which the controlling data in the program can be reviewed and edited are as follows:

REVIEW
- Sync
- Command
- Blend
- Load Share

PROGRAM
- Sync
- Command
- Blend
- Load Share

SETUP
- System

2.3.3 KEYPAD/DISPLAY PANEL SETUP

The following procedure must be completed prior to operating the engine/generator with the Pow-R-Con™.

NOTE: This setup procedure must be performed with the Keypad/Display Panel.

Supply the proper DC voltage (16-30VDC) to the Pow-R-Con™ at Battery terminals 23 (+) and 24 (-) and to the Keypad/Display Panel.

The first screen to appear should be:

Panel Display *Version: xx*

The second set of check screens will automatically be displayed:

Checking Comm at 1200, 4800

Checking Controller *Version: xx*

(xx will be the version of software)
If communications are functioning properly, the monitoring screen will be displayed in scroll mode.
Using the keys listed previously, and the list of default values for each control parameter listed, continue in the setup mode for each Pow-R-Con™ used, followed by the program mode.

1. Select Setup Mode.
2. Enter Password. Press the ENT, DEC, SCROLL (left), and SELECT keys for the password.
3. Select System Screen.
4. Enter the one-hundred percent power rating of the generator in the setup mode (Gen Pwr) when entering that value.
5. Enter the line-to-line voltage at the terminals in the setup mode (Volt Range) when entering that value. Pow-R-Con™ uses this voltage together with the installed PT ratio to measure actual line-to-line voltage for internal calculations.
6. Enter the generator frequency (Bus Freq) to be used in the Pow-R-Con™ calculations. Choices of frequency are 50 or 60 Hz.
7. Enter the ratio of the line-to-line voltage of the step down transformer. If there is no potential transformer, the ratio inserted should be 1. The correct ratio must be typed in.
8. Enter the ratio of the potential and current transformers. Although ratios for current transformers are stated as 250 to 5, the number to be inserted here is to be the lowest common denominator value (eg. 50 for 250 to 5). Step through remaining Functions/Parameters to customize Pow-R-Con™ for proper application.
9. Escape back to Setup System.

2.3.4 POWER LEVEL POT CALIBRATION

1. Select Setup Mode.
2. Enter Password. Press the ENT, DEC, SCROLL (left), and SELECT keys for the password.
3. Select System Screen.
4. Select Power Pot.
5. Select Power Pot CW, then Enter to calibrate.
6. Set Pot fully CW and press Enter.
7. Select Power Pot CCW, then Enter to calibrate.
8. Set Pot fully CCW and press Enter.

2.3.5 4 to 20 mA CALIBRATION

1. Select Setup Mode.
2. Enter Password. Press the ENT, DEC, SCROLL (left), and SELECT keys for the password.
3. Select Power Monitor.
4. With engine running with no load:
   - Press Enter and Inc/Dec to adjust I Low Power Value until meter reads zero.
   - Press Escape when completed.
5. With full load on engine:
   - Press Enter and Inc/Dec to adjust I High Power until meter reads full load value.
   - Press Escape when completed.

A complete list of the Keypad/Display Panel menu structure, data entry descriptions, and ranges areprovided as follows:

KEYPAD/DISPLAY PANEL MENU STRUCTURE

MODE	SCROLL	DISPLAY READOUT	DESCRIPTION	RANGE	DEFAULT
Review	Sync	Phase Over = _%	Phase Overall Gain	0-100	15
		Phas Prop = _%	Phase Proportional Gain	0-100	35
		Phas Intg = _%	Phase Integral Gain	0-100	30
		Freq Over = _%	Frequency Overall Gain	0-100	28
		Freq Prop = _%	Frequency Proportional Gain	0-100	50
		Freq Intg = _%	Frequency Integral Gain	0-100	75
		Volt Match = _%	Voltage Match Window	±1-±15	1.0
		Freq Match = _ HZ	Frequency Match Window	±0.1-±25	.12
		Phase Match = DEG	Phase Match Windows	±2-±20	10
	Command	Pwr Input = POT	Power Set Select	Key,Pot	Pot
		Pwr LO Limit = _%	Power Limit Low	0-100	10
		Pwr HI Limit = _%	Power Limit High	0-120	80
		Pwr Set Lvl = _%	Power Set Level	0-120	50
		Trip Level= _%	Breaker Trip Level	0-120	15
		Ramp Up = _SEC	Ramp Up Time	0-300	20
		Ramp Down = _SEC	Ramp Down Time	0-300	20
	Blend	Pwr LO Limit= _%	Power Limit Low	0-100	10
		Trip Level= _%	Power Set Level	0-120	50
		Ramp Up = _SEC	Ramp Up Time	0-300	20
		Ramp Down = _SEC	Ramp Down Time	0-300	20
	L/s Setup	Parall Volt = _V	Parallel Voltage	1.5-4.5	3.000
		PT Ratio = _	Potential Transformer Ratio	1-600	1
		CT Ratio A = _	Current Transformer Ratio A	10-9999	1.0
		CT Ratio B = _	Current Transformer Ratio B	10-9999	1.0
		CT Ratio C = _	Current Transformer Ratio C	10-9999	1.0
		Gene Power = _KW	Nominal Generator Power	0-2500	1
	L/s Relay	Pwr ON Lvl = _%	Forward Preset Power Level On	20-120	60
		Pwr OFF Lvl= _%	Forward Preset Power Level Off	10-100	30
		Rev Pwr Lvl = _%	Reverse Preset Power Level	0-40	20
		Fpwr ON Del = _SEC	Forward Power On Time	0-300	10
		Fpwr OFF Del = SEC	Forward Power Off Time	0-300	10
Program	Sync	Phas Over = _%	Phase Overall Gain	0-100	15
		Phas Prop = _%	Phase Proportional Gain	0-100	35
		Phas Intg = _%	Phase Integral Gain	0-100	30
		Freq Over = _%	Frequency Overall Gain	0-100	28
		Freq Prop = _%	Frequency Proportional Gain	0-100	50
		Freq Intg = _%	Frequency Integral Gain	0-100	75
		Volt Match = _%	Voltage Match Window	±1-±15	1.0
		Freq Match = _hz	Frequency Match Window	±0.1-±25	.12
		Phase Match = _DEG	Phase Match Windows	±2-±20	10
	Command	Pwr Input = _POT	Power Set Select	Key,Pot	Pot
		Pwr LO Limit = _%	Power Limit Low	0-100	10
		Pwr HI Limit = _%	Power Limit High	0-120	80
		Pwr Set Lvl = _%	Power Set Level	0-120	50
		Trip Level = _%	Breaker Trip Level	0-120	15
		Ramp Up = _SEC	Ramp Up Time	0-300	20
		Ramp Down = _SEC	Ramp Down Time	0-300	20
	Blend	Pwr LO Limit= _%	Power Limit Low	0-100	10
		Trip Level = _%	Power Set Level	0-120	50
		Ramp Up = _SEC	Ramp Up Time	0-300	20
		Ramp Down = _SEC	Ramp Down Time	0-300	20

MODE	SCROLL	DISPLAY READOUT	DESCRIPTION	RANGE	DEFAULT
Program	L/s Setup	Parall Volt = _V	Parallel Volt	0-4.5	3.000
		PT Ratio = _	Potential Transformer Ratio	1-600	1
		CT Ratio A = _	Current Transformer Ratio A	10-9999	1.0
		CT Ratio B = _	Current Transformer B	10-9999	1.0
		CT Ratio C = _	Current Transformer Ratio C	10-9999	1.0
		Gen Power = _KW	Nominal Gen Power	0-2500	1
	L/s Relay	Pwr ON Lvl = _%	Forward Preset Power Level On	20-120	60
		Power OFF Lvl = _%	Forward Preset Power Level Off	10-100	30
		Rev Pwr Lvl = _%	Reverse Preset Power Level	0-30	20
		Fpwr ON De= _SEC	Forward Power On Time	0-300	10
		Fpwr OFF De = _SEC	Forward Power Off Time	0-300	10
Setup	System	Gen Pwr = _KW	Generator Power	0-2500	1
		Sys Volt =_VAC	System Voltage	120,240, 480	120
		Bus Freq =_Hz	Bus Frequency	50,60	60
		PT Ratio =_	Potential Transformer Ratio	1-600	1
		CT Ratio A =_	Current Transformer Ratio A	10-9999	1.0
		CT Ratio B =_	Current Transformer Ratio B	10-9999	1.0
		CT Ratio C =_	Current Transformer Ratio C	10-9999	1.0
		Bridge Int =	Bridge Integrator	On.Off	Off*

2.4 FRONT END SOFTWARE OPERATION

The Barber-Colman Pow-R-Con™ is factory calibrated. When supplied with the required set-up information of the particular installation, it will permit proper operation of the engine/generator. A calibration procedure is also included in this section to check and/or improve the operation of the system.

NOTE: The setup information can be pre-set in the Pow-R-Con™ "off site" without having the engine/generator attached. The Pow-R-Con™ must be attached to the proper operating engine/generator to test the calibration or to improve the operation by changing the calibration software.

WARNING: THE FOLLOWING MUST BE SETUP IN THE Pow-R-Con™ BEFORE OPERATING THE ENGINE/GENERATOR. FAILURE TO PERFORM THIS INSTALLATION COULD RESULT IN OVERLOADING AND/ OR CAUSING DAMAGE TO THE ENGINE/GENERATOR EQUIPMENT.

2.4.2 EQUIPMENT

The following equipment is required to be used to install the setup information and to calibrate or check the settings of the Pow-R-Con™:

- IBM Compatible computer with a minimum 486 processor running at 66MHZ or greater
- 8 Megabytes RAM
- 3.5 in. floppy disc drive
  5 Megabytes free hard drive space
- Free serial comm. port (Software defaults to comm. port 1)
- DOS available. (Must restart computer under DOS if Win 95 is installed)
- Mouse useful but not required
- Barber Colman RS 485 Converter – To convert from RS-232 to RS-485 (p/n DYNK-55000)

NOTE: The output of the converter connects to terminals 49 (RS-485 A), and 50 (RS-485 B).

Access our website for the software:
www.dynaproducts.com
Double-click on "Software"
Double-click on "94025zip.exe"
Proceed with download by specifying file destination.

2.4.3 PC FRONT END SOFTWARE SETUP

The following procedure must be completed prior to operating the engine/generator with the Pow-R-Con™.

NOTE: This setup procedure must be performed without the Keypad/Display Panel mounted to the main Pow-R-Con™ PC board. This software must be run from Dos, not under Windows.
Using the equipment as specified in the above proceed as follows:

1. Supply the proper DC voltage (16-30VDC) to the Pow-R-Con™ at Battery terminals 23 (+) and 24 (-).

2. Connect the output of the RS485 interface to terminals 49(A) and 50 (B) and connect the "D" connector to computer's communications Port 1.

3. Install the software onto the computer's hard drive.

4. Unzip the files by typing 94025zip.

5. To run software type 94025040.

The first screen to appear should be the Copyrights Screen which is a rectangular data block within a "woven outline pattern" showing :

Barber Colman Controller Communications *Copyright 1993 ©* *Barber Colman a Siebe Company* *All Rights Reserved*

The second screen to appear is the LOG IN screen. Type BCC and press the ENTER key for USER. Type OEM and press the ENTER key for PASSWORD.

Once the password has been entered, the third screen will appear with:

Checking Communications with 94025 at 4800 baud.(baud rate may be different)

NOTE: Should a red error screen appear, indicating noise or failure in communications, recheck input power, RS-485, and laptop interface connections.

If the setup information has not been set into the Pow-R-Con™ for the specific generator being used, the following message will appear:

"This unit is not setup properly. Before running the engine, select the Setup sub-menu from the Engineering menu and perform the setup of the Pow-R-Con™. Please press any key to continue."

NOTE: If the PT ratio and the CT ratio are both 1 Pow-R-Con™ will not operate the engine/generator and the above message will appear. The factory defaults for the PT and CT ratio are both 1.

Once the communications check has been completed, the Main Menu will appear with:

Engineering	*System*	*Files*
Calib	*cOmm*	*eXit*

Opening any of these sub-menus can be obtained by using the arrow keys or the mouse to highlight the word and pressing ENTER. Typing the capitalized letter (hot key) of the file name (shown above) also accesses the menu.

1. Open the Engineering screen.

2. In the Engineering screen, open the Setup screen.

The information listed on the Setup screen must be entered in order for the Pow-R-Con™ to operate. (The factory calibration uses this information to measure and determine operating parameters.) Information is set by using the arrow keys or the mouse to highlight the parameter being inserted. For those functions which do not automatically enter the new value, one must hit the ENTER key to install the proper data prior to changing the screen by hitting ESC. Information to be supplied is as follows:

Enter the one-hundred percent power rating of the generator.

Gen power rating	*:*	*xxxx.xxx kWatts*

Enter the line to line voltage at the terminals. The Pow-R-Con™ uses this voltage in conjunction with the installed PT ratio to measure the actual line to line voltage for use in its calculations.

NOTE: Select one of three input voltages for the following ranges: Select 120 for100v to 160v range; select 240 for 160v to 320v range; select 480 for 320v to 600v range.

Voltage range	*:*	*480*	*Vac*

Enter the generator frequency to be used in the Pow-R-Con™ calculations. Choices of frequency are 50 or 60 Hz.

Bus frequency	*:*	*60*	*Hz*

Enter the ratio of the line to line voltage of the step down transformer. If there is not a potential transformer, the ratio inserted should be 1. This ratio must be typed in with the appropriate number.

PT ratio:	*xxx.xx*	*Volts*

Enter the ratio of the current transformer. Although ratios for current transformers are stated as 250 to 5, the number to be inserted here is to be the lowest common denominator value -eg. 50 for 250 to 5. This ratio must be typed in with the appropriate number. The range is 1 to 600 .

CT ratio:	*xxx.xx*	*Amps*

Escape from Setup when completed.

If using Power Monitor output, enter Set Pow. Mon. Setpts. Increase/decrease Dutycyc Low with no load on generator until meter reads zero.

Place full load on generator and adjust Duty Cycle High to make meter read full load. Escape to Main Menu when complete.

. If using Power Level Potentiometer, enter Calibration Screen.
2. Enter Cal. Power Set Low.
3. Press Enter if new calibration or F10 if recalibrating.
4. Set Pot CCW.
5. Press Enter twice.
6. Enter Cal Power Set High.
7. Press Enter if new calibration or F10 if recalibration.
8. Set Pot CW.
9. Press Enter twice.
10. Escape back to Main Menu.

Step through remaining Functions/Parameters to customize Pow-R-Con™ for proper application. Exit out to DOS shell when calibration is complete.

A complete list of the frontend software menu structure, data entry descriptions, and ranges are provided as follows:

FRONTEND SOFTWARE MENU STRUCTURE

MODE	SCROLL	SCREEN READOUT	DESCRIPTION	RANGE	DEFAULT
Engineering	Auto Sync	PhsPID_PGain : %	Phase Proportional Gain	0-100	35
		PhsPID_IGain : %	Phase Integral Gain	0-100	30
		PhsPID_DGain : %	No Adjustment	-	0
		PhsPID_O_Gain : %	Phase Overall Gain	0-100	0
		bus frequency : Hz	Display Only	-	-
		gen frequency : Hz	Display Only	-	-
		phase error : Deg	Display Only	-	-
		control mode :	Display Only	-	-
		FrqPID_OGain : %	Frequency Overall Gain	0-1-00	28
		FrqPID_PGain : %	Frequency Proportional Gain	0-100	50
		FrqPID_IGain : %	Frequency Integral Gain	0-100	75
		FrqPID_DGain : %	No Adjustment	-	0
		sync pwmdrive : %	Display Only	-	-
		hz ena Pha PID : Hz	No Adjustment	-	0.5
		brk close output	Display Only	-	-
	VFP match	bus frequency : Hz	Display Only	50, 60	-
		gen frequency : Hz	Display Only	-	-
		match voltage :	Voltage Match Window	±1-±15	Zero
		freq :	No Adjustment	-	Zero
		phase :	No Adjustment	-	Zero
		gen freq present :	Display Only	-	-
		synch input :	Display Only	-	-
		breaker aux :	Display Only	-	-
		brk close output :	Display Only	-	-
		volt match win : %	Voltage Match Window	±1-±15	1.0
		freq match win : Hz	Frequency Match Window	±0.1-±25	0.12
		phase match win : Deg	Phase Match Window	±2-±20	10.000
		phase predictor : Deg	No Adjustment	-	0.005
		Vbus : Vrms	Display Only	-	-
		Vgen : Vrms	Display Only	-	-
	Setup	Gen power rating : kWatts	Generator Power	0-2500	1.000
		Voltage range : Vac	System Voltage	-	120
		bus Frequency : Hz	Bus Frequency	50,60	60
		PT ratio :	Potential Transformer Ratio	1-600	1
		CT ratio A :	Current Transformer Ratio A	10-9999	1.0
		CT ratio B :	Current Transformer Ratio B	10-9999	1.0
		CT ratio C :	Current Transformer Ratio C	10-9999	1.0
		bridge Integrator :	Bridge Integrator	On, Off	Off
	ILS	total average pwr : kVars	Display Only	-	-
		average reactive : kVars	Display Only	-	-
		inst power : kWatts	No Adjustment	-	-
		fulload brdge volt :	No Adjustment	-	3.00

MODE	SCROLL	SCREEN READOUT	DESCRIPTION	RANGE	DEFAULT
		ils pwmdrive : %	Display Only	-	-
		pt ratio :	No Adjustment	-	1
		genpower kwatt : kWatts	No Adjustment	-	1.000
		flt hi pfactr ph 1 :	Display Only	-	-
		flt hi pfactr ph 2 :	Display Only	-	-
		flt hi pfactr ph 3 :	Display Only	-	-
		average pfactor :	Display Only	-	-
		real power ph 1 : kWatts	Display Only	-	-
		real power ph 2 : kWatts	Display Only	-	-
		real power ph 3 : kWatts	Display Only	-	-
		reactive powr ph 1 : kVars	Display Only	-	-
		reactive powr ph 2 : kVars	Display Only	-	-
		reactive powrph 3 : kVars	Display Only	-	-
		CT ratio A :	No Adjustment	-	1.0
		CT ratio B :	No Adjustment	-	1.0
		CT ratio C :	No Adjustment	-	1.0
Engineering	ILS	control mode	Display Only	-	-
	measured RMS	bus voltage 1 2 : Vrms	Display Only	-	-
		gen voltage 1 N : Vrms	Display Only	-	-
		gen voltage 2 N : Vrms	Display Only	-	-
		gen voltage 3 N : Vrms	Display Only	-	-
		gen current ph 1 : AMPS	Display Only	-	-
		gen current ph 2 : AMPS	Display Only	-	-
		gen current ph 3 : AMPS	Display Only	-	-
		bus v 1 2 filt hi : Vrms	Display Only	-	-
		gen v 3 1 filt hi : Vrms	Display Only	-	-
	relay Control	for power on lvl : %	Forward Preset Power Level On	20-120	60
		for power off lvl : %	Forward Preset Power Level Off	10-100	30
		rev power lvl : %	Reverse Preset Power Level	0-30	20
		for power on del : Sec	Forward Power On Time	0-300	10
		for power off del : Sec	Forward Power Off Time	0-300	10
	Blend/ command	ramp pwmdrive : %	Display Only	-	-
		power set select :	Power Set Select	Pot	Potentio
		power lo lmt : %	Power Limit Low	0-100	10
		power hi lmt : %	Power Limit Hi	0-120	80
		power set lvl : %	Power Set Level	0-120	50
		brkr trip lvl : %	Breaker Trip Level	0-40	15
		rampup rate : Sec	Ramp Up Time	0-300	20
		rampdown rate : Sec	Ramp Down Time	0-300	20
		synch :	Display Only	-	-
		breaker aux :	Display Only	-	-
		breaker trip :	Display Only	-	-
		blend mode :	Display Only	-	-
		command mode :	Display Only	-	-
		load gen :	Display Only	-	-
		unload gen :	Display Only	-	-
		ils pwmdrive : %	Display Only	-	-
	set power Monitor setpoints	User Calibration	No Adjustment	-	-
		Duty cycle low pwr : %	4 ma Calibration	-	15.36
		duty Cycl high pwr : %	20 ma Calibration	-	75.50
		percent Low pwr : %	No Adjustment	-	0.0
		percent High pwr : %	No Adjustment	-	100.0

MODE	SCROLL	SCREEN READOUT	DESCRIPTION	RANGE	DEFAULT
System	Gains	Gains displayed in :	Select Units to be Displayed.	-	%
	Rolloffs	Rolloffs displayed in :	Select Units to be Displayed.	-	Hertz
	Voltage	Par line voltage :	Select Units to be Displayed.	-	3.00
rIles	Copy File	copy File to controller	No Adjustment	-	-
	Copy Controller	copy Controller to file	No Adjustment	-	-
Calib	calibrate power set Low	calibrate power set Low	Upon Selection the Low Power Set will be Calibrated.	-	-
	calibrate power set High	calibrate power set High	Upon Selection the High Power Set will be Calibrated.	-	-
cOmm	cOmm Port	COMM1 COMM2 COMM3	Select Communication Port	-	COMM1
	Save Data	Save Data	No Adjustment	-	
	Baud Rate	2400 4800 9600 19200 38400	Select Communication Port	-	4800
	eXit	eXit	Exit to Main Menu	-	-
eXit	-	eXit	Exit from Frontend Software	-	-

3.0 CALIBRATION

3.1 GENERAL

Most user adjustments are made through the Keypad/Display Panel on the controller or from a laptop through the RS-485 interface and front end software. Droop (R146) and Load Pulse (R148) adjustments are made by potentiometers under the cover.

Dip switches (see Section 4.7) are provided for selecting the type of governor with potentiometers to adjust the span and the offset of the speed setting output to the governor.

3.2 AUTO SYNC CALIBRATION

CAUTION: THIS PROCEDURE MUST BE PERFORMED PRIOR TO PLACING THE Pow-R-Con™ IN UNSUPERVISED CONTROL OF THE ENGINE/GENERATOR.

CAUTION: BEFORE PROCEEDING, INSURE THAT ENGINE GOVERNOR INSTALLATION AND CALIBRATION HAVE BEEN PROPERLY PERFORMED ACCORDING TO MANUFACTURER'S REQUIREMENTS.

3.2.1 INITIAL SETUP

NOTE: Prior to making any Pow-R-Con™ adjustments, record all previously setup parameters or refer to menu structure charts for default values for phase and frequency control inputs.

NOTE: The new unit being placed on-line must reach a speed equal to the unit already on- line ± 1.5 Hz from nominal.

The control values to be entered to achieve calibration, are as follows:

Phase Parameters
- . Overall
- Proportional
- Integral
- Derivative (frontend software only - contact factory to change the default value)

Frequency Parameters
- Overall
- Proportional
- Integral
- Derivative (frontend software only - contact factory to change the default value)

NOTE: Interaction occurs between phase and frequency elements during normal operation. To eliminate this interaction during calibration, only one set of values is calibrated at a time.

3.2.2 FREQUENCY CALIBRATION

Frequency calibration should be performed first, followed by phase calibration. Use the following steps as a guide to obtain initial calibration. Additional adjustments may be required to optimize the operation of each engine/generator unit.

1. Set all phase and frequency control input parameters to zero (0) or OFF.

2. Set the frequency overall gain value to 50%.

   NOTE: When entering new control parameters, enter the lowest setting and monitor the results.

   NOTE: Switch between sync disable and sync enable to observe any instability using a synchroscope or oscilloscope.

3. Begin increasing the proportional value to achieve instability, followed by the integral if necessary.

   NOTE: Make increases by doubling the previous input (ie.: 10, 20, 40) if the system remains slow to respond. Continue increasing each value until the system becomes rapidly unstable, at which time decrease the input by half the previous increase (ie.: 15, 30).

4. If stability cannot be achieved, reduce the proportional and integral gain values to minimum, and set the overall gain value higher or lower. This overall gain input acts as a sensitivity adjust for the other frequency control input values.

   NOTE: If the proportional and integral values fail to achieve stability (fast oscillations), reduce the overall gain to 25% and readjust the individual proportional, followed by integral values. Continue in this manner, adjusting the overall gain to achieve the correct sensitivity for the system.

   NOTE: If the proportional and integral values are increased significantly without achieving stability (slow oscillations), increase the overall gain to 75% and readjust the individual proportional, followed by integral values. Continue in this manner, adjusting the overall gain to achieve the correct sensitivity for the system.

5. Reset frequency back to as close to bus frequency as possible If sync stability is not achievable verify frequency using the above calibration steps 1-4.

3.2.3 PHASE CALIBRATION

Phase calibration should be performed after equency calibration. . Use the following steps as a guide to obtain initial calibration. Additional adjustments may be required to optimize the operation of each engine/generator unit. It may be necessary to readjust the frequency parameters after performing the phase calibration.

1. Set the phase overall gain value to 50%.

   NOTE: When entering new control parameters, enter the lowest setting and monitor the results.

   NOTE: Switch between sync disable and sync enable to observe any instability using a synchroscope or oscilloscope.

2. Begin increasing the proportional value to achieve stability, followed by the integral if necessary.

   NOTE: Make increases by doubling the previous input (ie.: 10, 20, 40) if the system remains slow to respond. Continue increasing each value until the system becomes rapidly unstable, at which time decrease the input by half the previous increase (ie.: 15, 30).

3. If stability cannot be achieved, reduce the proportional and integral gain values to minimum, and set the overall gain value higher or lower. This overall gain input acts as a sensitivity adjust for the other frequency control input values.

   NOTE: If the proportional and integral values fail achieve stability (fast oscillations), reduce the overall gain to 25% and start over adjusting the individual proportional, followed by integral values. Continue in this manner, adjusting the overall gain to achieve the correct sensitivity for the system.

   NOTE: If the proportional and integral values are increased significantly without achieving stability (slow oscillations), increase the overall gain to 75% and start over adjusting the individual proportional, followed by integral values. Continue in this manner, adjusting the overall gain to achieve the correct sensitivity for the system.

4.0 INSTALLATION

4.1 SPECIFICATIONS

- Voltage input 3-phase, 50/60 Hz
  120-480 VAC ± 15%
- Current input 3-phase, 5A at Max. gen. load
  Burden 1.25VA per phase at 5.0 A
- Load Sharing Within ± 0.5% Accuracy
- Output 1.5-5.0VDC full load (Paralleling Lines)
- Operating Temperature: -20 to 70° C
- Shipping/Storage Temperature: -40 to 85° C

4.2 FIELD WIRING

Terminal blocks accept maximum 16 Awg.

Input/output wiring required to be twisted and shielded, with minimum of (5) twists per foot.

4.3 MOUNTING

- Four corner holes are provided for panel mounting the Pow-R-Con™ .

4.4 POWER SUPPLY

- DC nominal range from IEC-204-1
- Normal operation from 16 volts to 30 volts DC.

4.5 SYSTEM INPUTS/OUTPUT

Quick-connect screw terminals are conveniently located on outboard sides of the Pow-R-Con™ unit.

The following field connections are provided:

NOMENCLATURE	DESIGNATION	TERMINAL	DESCRIPTION
Generator Voltage Input	Gen Volt	1, 2, 3	3-phase generator voltage input of 120 to 480 VAC and frequency 50/60 Hz. Nominal voltage and frequency is entered through the keypad/display interface.
Generator Current Input	Gen Cur	4, 5, 6, 7	0-5A CT connections of generator current for phases 1, 2 and 3 respectively and terminal 7 is the CT common.
Bus Voltage Input	Bus Volt	8, 9	Line to line (1-2) bus voltage input of 120 to 480 VAC and frequency 50/60 Hz. Nominal voltage and frequency is entered through the keypad/display interface.
Forward Power On Relay	Forward Power On	10 11	Normally open contact rated at 5A at 120VAC resistive which is energized when the generator power goes above an adjustable preset (20-120) percentage of the full load.
Forward Power Off Relay	Forward Power Off	12 13	Normally open contact rated at 5A at 120VAC resistive which is energized when the generator power goes below an adjustable preset (10-100) percentage of the full load, after the forward power relay is energized.
Reverse Power On Relay	Reverse Power On	14 15	Normally open contact rated at 5A at 120VAC resistive which is energized when the generator goes into reverse power beyond an adjustable preset (0-40) percentage of full load.
Voltage Increase Relay Voltage Decrease Relay	Voltage Increase Voltage Decrease	16, 17 17, 18	Normally open contacts rated at 5A at 120VAC resistive which are energized during synchronizing to increase or decrease generator voltage to match the bus voltage magnitude. Terminal 17 is common.
Breaker Trip Relay	Breaker Trip Output	19 20	Normally open contact rated at 10A at 240VAC resistive for breaker tripping when separating from the bus in an unload operation.
Breaker Close Relay	Breaker Close Output	21 22	Normally open contact rated at 10A at 240VAC resistive for breaker closing when synchronized to the bus.
Battery ±	Batt + Batt -	23 24	16-30 VDC power source for the optional door mounting of the display unit.
Shield			Shield termination screws.
External Power Set	CCW Pwr Set CW	25 26 27	5K external potentiometer for optional remote setting of the power level in command mode operation.
Governor Speed Set	Gov Spd Set	28	Governor's speed setting.
Governor Reference	Gov Ref	29	Governor's speed reference voltage input.
Speed Set	CCW Speed Set	30 31	5K external potentiometer for remote setting of the engine speed/frequency.

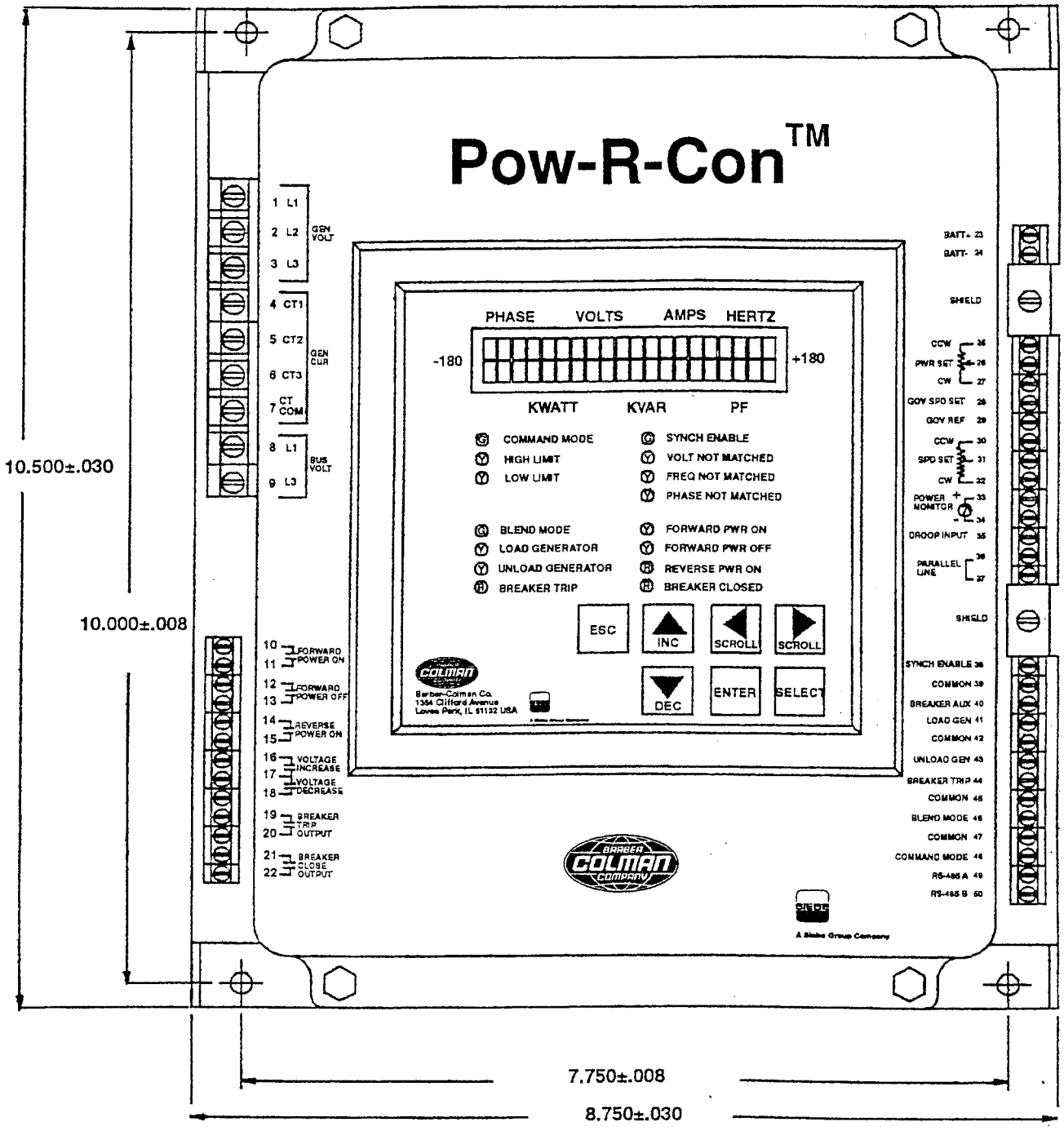
NOMENCLATURE	DESIGNATION	TERMINAL	DESCRIPTION
	CW	32	
Power Monitor	Power Monitor + Power Monitor -	33 34	4-20 mA output proportional to the power output of the generator.
Droop Input	Droop Input	35	When jumpered to terminal 37, changes the load sharing from isochronous to droop.
Parallel Line	Parallel Line	36 37	Connect to the system paralleling lines. DC voltage proportional to generator's load.
Shield			Shield termination screws.
Synch Enable	Synch Enable	38	Digital input to enable the synchronizer. Digital inputs are enabled by connection to common terminal 39.
Common	Common	39	Common connections for the digital inputs.
Breaker Auxiliary Enable	Breaker Aux.	40	Digital input to indicate generator breaker status. A signal from a breaker auxiliary contact must be connected between terminal 46 and one of the common terminals.
Load Generator Enable	Load Gen	41	Digital input to start ramping load to the generator. While the input is enabled, ramping continues until the generator output matches the load sharing level in the blend mode or the command level in the command mode.
Common	Common	42	Common connections for the digital inputs.
Unload Generator Enable	Unload Gen	43	Digital input to start ramping down the load to the generator. While the input is enabled, ramping continues until the generator output reaches the adjustable low limit.
Breaker Trip Enable	Breaker Trip	44	Digital input to energize the breaker trip relay during separation of a generator from a bus. This input must be enabled and the breaker trip reached before the breaker trip relay is energized.
Common	Common	45	Common connections for the digital inputs.
Blend Mode Enable	Blend Mode	46	Digital input to select the blend mode for the load ramping function.
Common	Common	47	Common connections for the digital inputs.
Command Mode Enable	Common Mode	48	Digital input to select the command mode for the load ramping function. If neither the command nor blend inputs are selected then the load ramping function is inactive, and Pow-R-Con™ acts as a standard load sharing module.
RS-485 Interface or Remote Keypad/Display Panel	RS-485 A RS-485 B	49 50	RS-485 interface for the optional door mounting of the display unit or PC connection.

4.6 KEYPAD/DISPLAY PANEL CONNECTIONS

NOMENCLATURE	CONNECTIONS	DESCRIPTION
Batt +	Outboard terminal (nearest edge of module).	Connects to 16-30 VDC power source (from terminal 23 of Pow-R-Con™ unit).
Batt -	Next to outboard terminal.	Connects to 16-30 VDC power source (from terminal 24 of Pow-R-Con™ unit).
Shield	Center terminal.	
RS-485 B	Next to inboard terminal.	To terminal 50 of Pow-R-Con™.
RS-485 A	Inboard terminal (nearest to center of keypad/display panel when facing display).	To terminal 49 of Pow-R-Con™.

4.7 Pow-R-Con™ /GOVERNOR SETTINGS

GOVERNOR	S1 SWITCH POSITIONS							
1=ON 0=OFF	1	2	3	4	5	6	7	8
Barber -Colman/ Cummins*	1	0	0	0	0	0	1	0
Woodward	1	1	0	0	1	0	1	0
DDEC	0	0	0	1	0	0	1	0
MC	0	0	0	0	1	0	0	1
Hinzman	1	0	1	0	0	0	1	0
* Cummins part nos.	3044195	3044196	3062322	3062323	3098693			


Pow-R-Con™
PHASE VOLTS AMPS HERTZ
-180
+180
KWATT KVAR PF
COMMAND MODE
HIGH LIMIT
LOW LIMIT
SYNCH ENABLE
VOLT NOT MATCHED
FREQ NOT MATCHED
PHASE NOT MATCHED
BLEND MODE
LOAD GENERATOR
UNLOAD GENERATOR
BREAKER TRIP
FORWARD PWR ON
FORWARD PWR OFF
REVERSE PWR ON
BREAKER CLOSED
ESC
INC
SCROLL
SCROLL
DEC
ENTER
SELECT
1 L1
2 L2
3 L3
GEN VOLT
4 CT1
5 CT2
6 CT3
7 CT COM
GEN CUR
8 L1
9 L3
BUS VOLT
10 FORWARD POWER ON
11
12 FORWARD POWER OFF
13
14 REVERSE POWER ON
15
16 VOLTAGE INCREASE
17
18 VOLTAGE DECREASE
19 BREAKER TRIP OUTPUT
20
21 BREAKER CLOSE OUTPUT
22
BATT+ 23
BATT- 24
SHIELD
CCW 25
PWR SET 26
CW 27
GOV SPD SET 28
GOV REF 29
CCW 30
SPD SET 31
CW 32
POWER MONITOR + 33
- 34
DROOP INPUT 35
PARALLEL LINE 36
37
SHIELD
SYNCH ENABLE 38
COMMON 39
BREAKER AUX 40
LOAD GEN 41
COMMON 42
UNLOAD GEN 43
BREAKER TRIP 44
COMMON 45
BLEND MODE 46
COMMON 47
COMMAND MODE 48
RS-485 A 49
RS-485 B 50
Barber-Colman Co.
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A Sloan Group Company
10.500±.030
10.000±.008
7.750±.008
8.750±.030

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