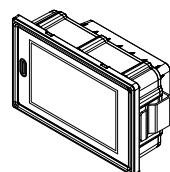
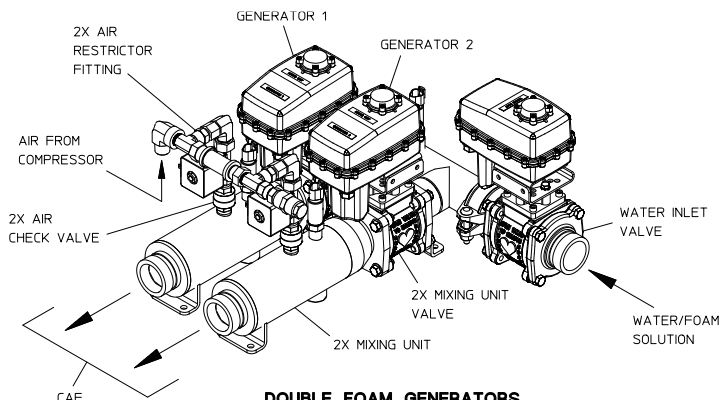




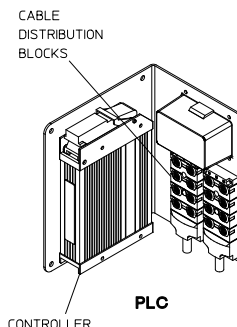
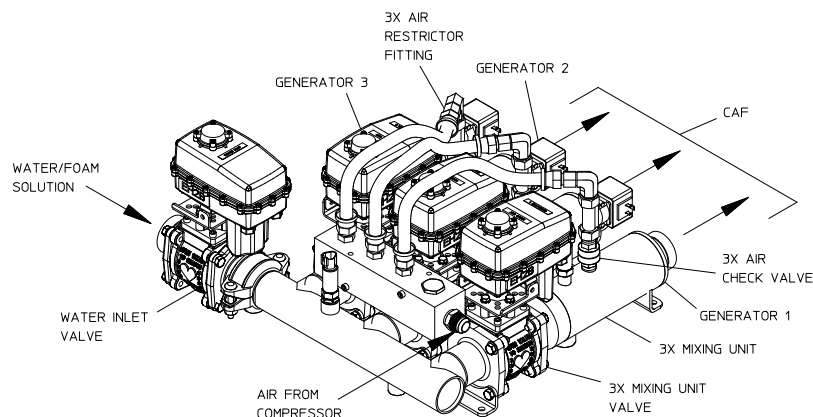
Eclipse GEN 2.0™ CAFSystem Generator and Controls Installation Instructions

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Eclipse GEN 2.0™ Generators and Controls	See DPL83637



HMI CONTROL
PANEL



CABLE
DISTRIBUTION
BLOCKS
CONTROLLER
PLC

TRIPLE FOAM GENERATORS



Read through the installation instructions carefully before beginning installation of the Eclipse GEN 2.0™.

NOTE: Instructions subject to change without notice

Introduction

The Waterous Eclipse GEN 2.0™ Generators and Controls Installation Instructions will aid in the installation of the Waterous Eclipse GEN 2.0™ system. The Waterous Eclipse GEN 2.0™ system provides an easy to use control panel to adjust CAFS to a necessary setting with just the touch of a few buttons.

Installation tasks include:

- Foam Generator Mounting
- PLC Panel Installation
- HMI Panel Installation

Safety Information

WARNING

Compressed air can be dangerous. Read and understand the operating instructions for the Waterous compressed air foam unit and individual components prior to operating.

WARNING

Discharge outlets that are capped, hose lines that are valved and charged and the air compressor sump may contain compressed air. Relieve all pressure before attempting to remove any caps, fittings and nozzles or to perform maintenance to prevent serious personal injury.

WARNING

Operating the compressed air foam unit with water and compressed air pumped through a discharge without foam concentrate will create a potentially dangerous condition known as “slug flow,” where unmixed pockets of water and air are passed through the nozzle, causing erratic nozzle reaction.

CAUTION

Nozzle reaction force is significantly increased at the time the nozzle valve is opened in compressed air foam operations. Open CAFS nozzles slowly.

CAUTION

Do not use the compressed air foam unit as an air source for SCBA or any breathing air supply

CAUTION

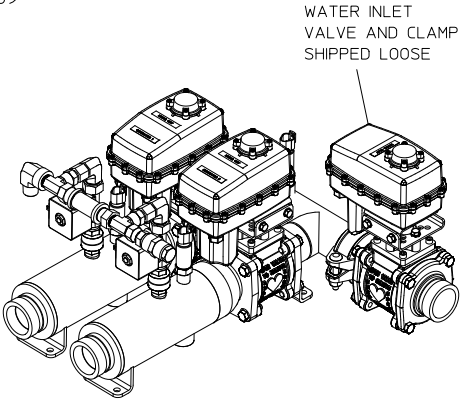
For compressed air foam operations, use only fire hose that is rated at 200 PSI or higher working pressure.

NOTICE

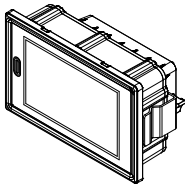
The unit operator should have a thorough understanding of “Boyle’s Law” (The law of compressed gases) prior to operating the compressed air foam unit.

Components Furnished

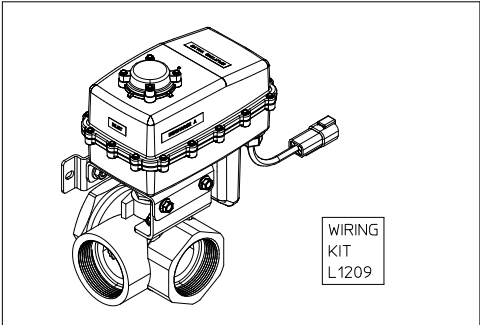
IL4469



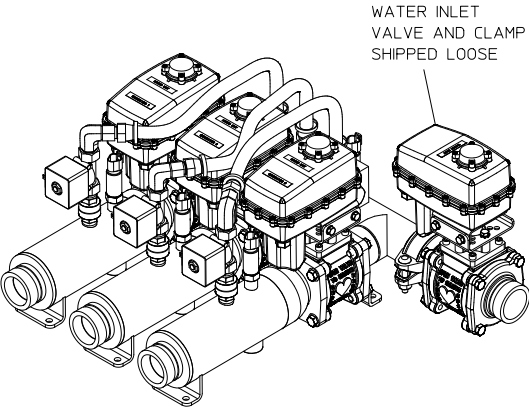
DOUBLE CAFS FOAMULATORS



HMI CONTROL
PANEL

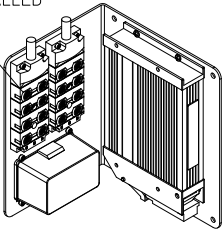


DISCHARGE SPLITTING VALVE,
9439

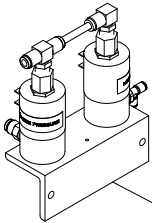


TRIPLE CAFS FOAMULATORS

ALL CABLES CONNECTED
HERE WILL BE INSTALLED
AT THE FACTORY



PLC



AUTO-SYNC FOR
ECLIPSE GEN 2.0 HIGH
RISE OPTION, 9395
FURNISHED WITH
COMPRESSOR

OPTIONAL COMPONENTS

SYSTEM SCHEMATIC



Installation – General Guidelines

Refer to the System Schematic in this instruction for system components and interconnectivity. Within the guidelines given here, components can be installed wherever there is room for them to be securely mounted.

Components must be bolted to brackets welded to the apparatus frame, or bolted directly to the frame.

CAUTION

Do not damage the vehicle chassis during installation. Check with the vehicle manufacturer to ensure the planned welds and bolts are in acceptable areas.

Make sure electronic devices that may be damaged are disconnected from the chassis before welding.

Do not manually actuate the foam generator control valves with the actuator installed. Damage to actuator calibration will occur.

Wires, hoses or tubing that passes through metal such as a compartment panel, must have a protective bushing or shield around the edges of the hose to protect against abrasion.

To prevent damage to wires, cables or tubing, or accidentally disconnecting them, run them along the support beams of the pump compartment whenever possible. Bundling and securing with cable ties or other fasteners is a good practice.

Installation – Foamulators

Location:

The generators should be located so that access can be made for cable connections, water inlet connections, CAFS discharge hose connections and a drain connection.

The generators must be mounted so that the discharges are horizontal.

Mounting:

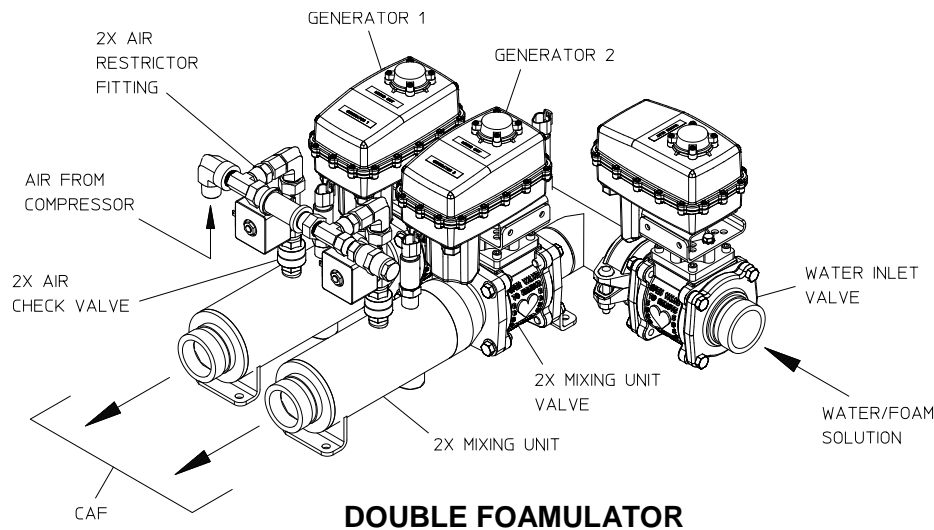
Note that the water inlet valve is shipped loose. Use the Victaulic clamp provided to connect to the Victaulic connection on the generator manifold.

Each generator has two right angle brackets each with two holes for mounting hardware. Use these brackets to attach the generators to the apparatus frame.

See drawing DPL83637 for dimensions.

Manifold Drain:

The manifold has one 1/4 in. NPT drain tap which is to be connected to the pump drain system.



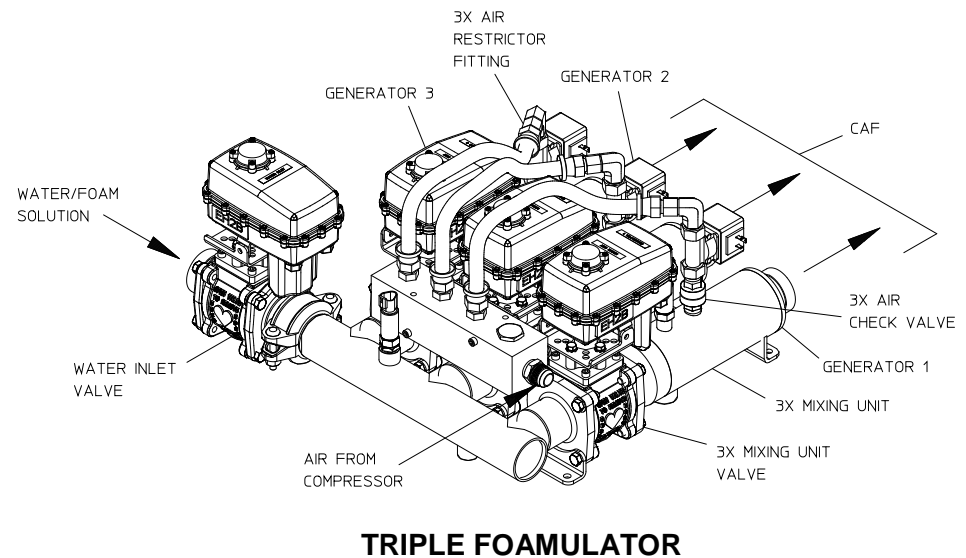
Generator Inlet:

Foam solution (water and foam concentrate) from the foam pump manifold must be brought to the generators through the 2 in. Victaulic connection on the water inlet valve. Hard plumbing or hose may be used. Waterous does not furnish this piping.

Generator Discharge:

Compressed air foam must be brought from the foam generators to the panel discharges with either hard plumbing or hose.

NOTE: Each generator is pre-set at the factory to use air for a specific discharge hose size. Check the order for the hose size each generator was set at the factory and ensure it is connected to the correct discharge on the apparatus.



PL83637

Installation – PLC Panel

Location:

The PLC should be located so that access can be made for future maintenance of electrical fuses and relays.

Mounting:

The PLC components are mounted on a right-angle bracket. It may be mounted horizontally or vertically. If mounting vertically, the cable connection between the cable blocks and PLC should be pointing down.

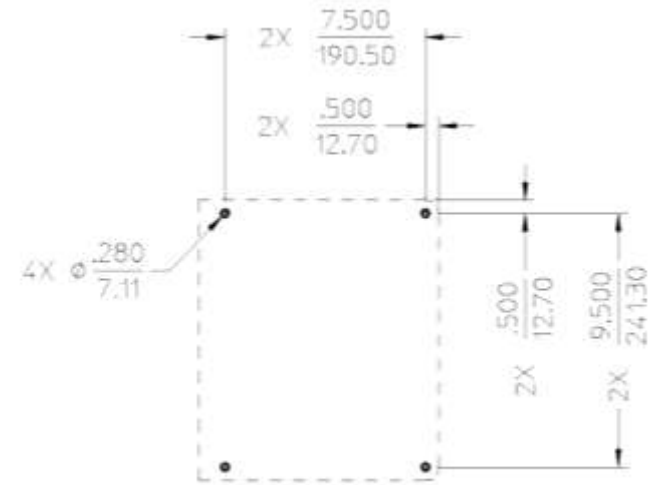
The bracket has four mounting holes. Mounting hardware is provided in air line tubing kit L1203.

Note that all cables connected to the distribution blocks are installed at the factory.

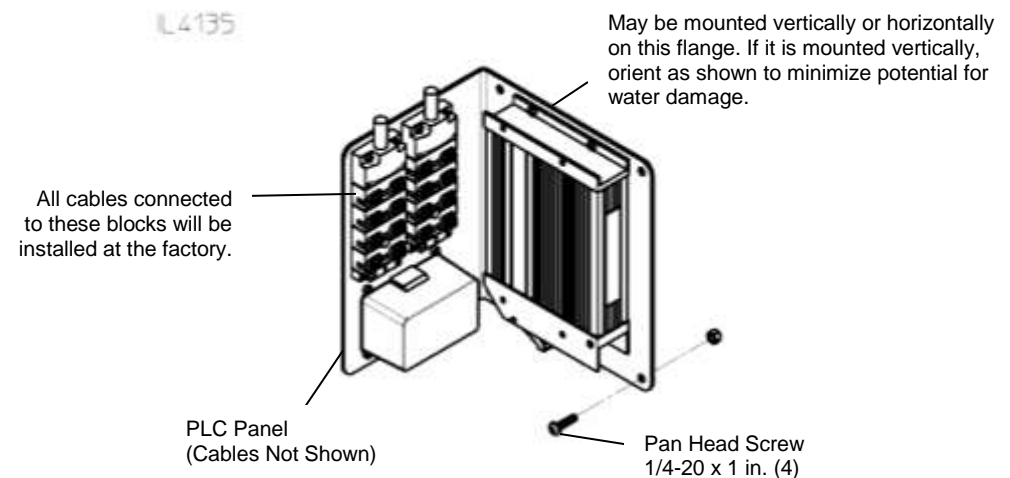
See drawing DPL83637 for dimensions.

Cable Connections to Generators, Regulators and HMI Panel:

See **Cable Connections** section of this instruction.



Panel Mounting Hole Layout



Installation – HMI Control Panel

Location:

The HMI should be located for easy access on the operator's panel.

Mounting:

A pre-defined cut out in the panel is required.

Remove the clamps from the HMI panel and use to attach to operator's panel from the back side.

Antenna:

If intending to use wireless control capabilities antenna must be mounted on an external surface with minimum blockage from surrounding metal. The top surface of the module is often an ideal location.

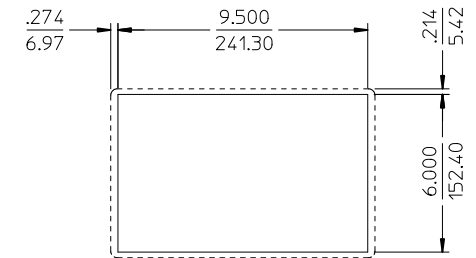
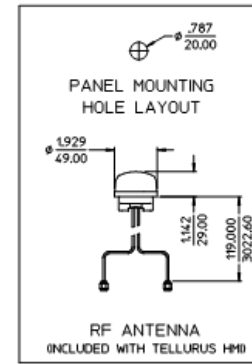
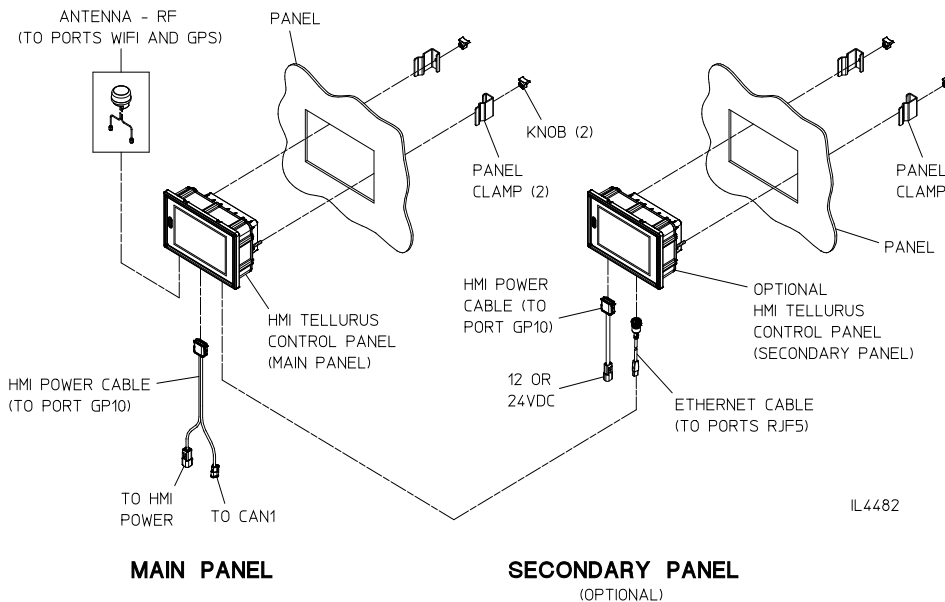
Power:

Main Panel – Power is provided through connection to the PLC.

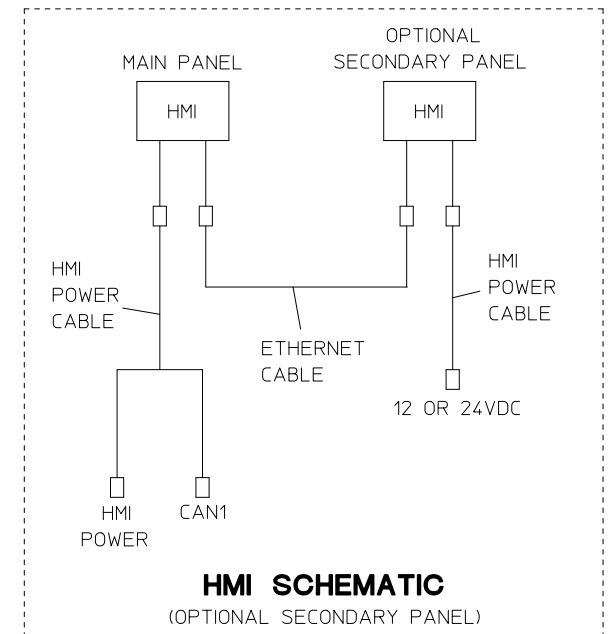
Optional Secondary Panel – Separate 12 or 24V power connection required.

Cable Connection to PLC:

See **Cable Connections** section of this instruction.



PANEL HOLE CUT OUT



Installation – Air Lines

Compressor to Foamulators

Compressor to Foam Generators:

Double Generators:

A 1/2 in. air line is required from the compressor separator filter 3/4 in. NPT tap to the foam generator air inlet #8 JIC fitting.

Triple Generators:

A 3/4 in. air line is required from the compressor separator filter 3/4 in. NPT tap to the foam generator air inlet #12 JIC fitting.

Note that the hose and fittings are available from Waterous in optional compressor Hose and Fitting kit. See compressor drawings.

Auxiliary Air Connection:

Auxiliary air may be extracted from the Foam Generator supply as follows.

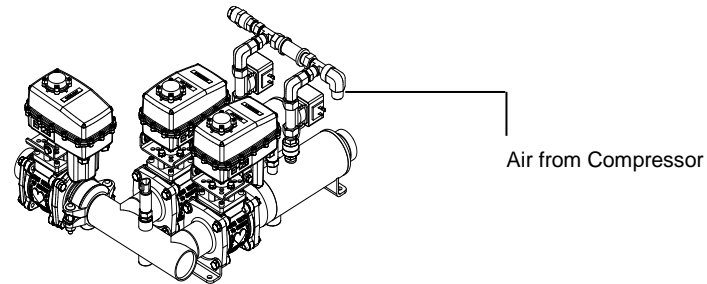
Double Generators:

A tee may be installed at the 1/2 in. connection between the compressor and foam generators. Waterous does not provide these fittings..

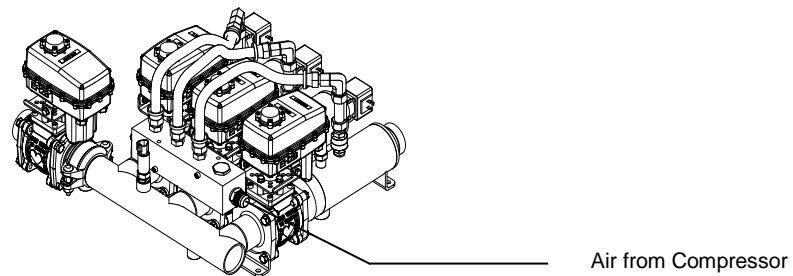
Triple Generators:

The un-used plugged 3/4 in. NPT port on the end of the air distribution block may be used.

Note that Auxiliary Air connection kits are available from Waterous. See compressor drawings.



DOUBLE CAFS FOAMULATORS



TRIPLE CAFS FOAMULATORS

Installation – Cable Connections

Waterous Supplied Cables:

Connect cables pre-installed on the PLC to Foam Generators, HMI and Compressor Components as shown in the diagrams on the following pages. Use the labels on the cable ends to identify connection location. Refer to cable schematics on the following pages.

Cable Routing:

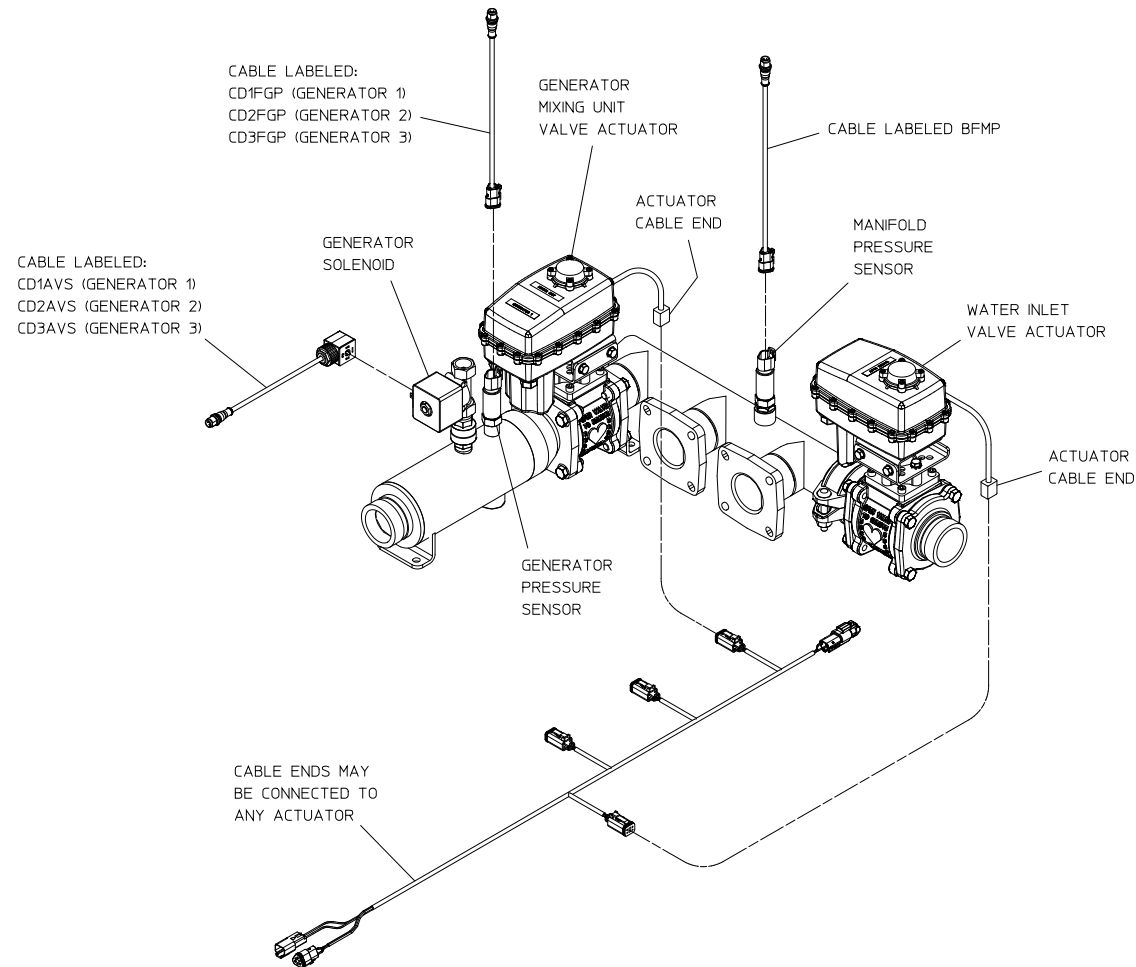
When routing cables, take care to avoid routing them next to antenna cables, radio power lines and radio components.

Extra Cable Length:

Making round coils of cables in the pump compartment can act as an antenna. When there is extra cable, double the cable back upon itself and secure in a flat bundle with wire ties rather than making a round coil.

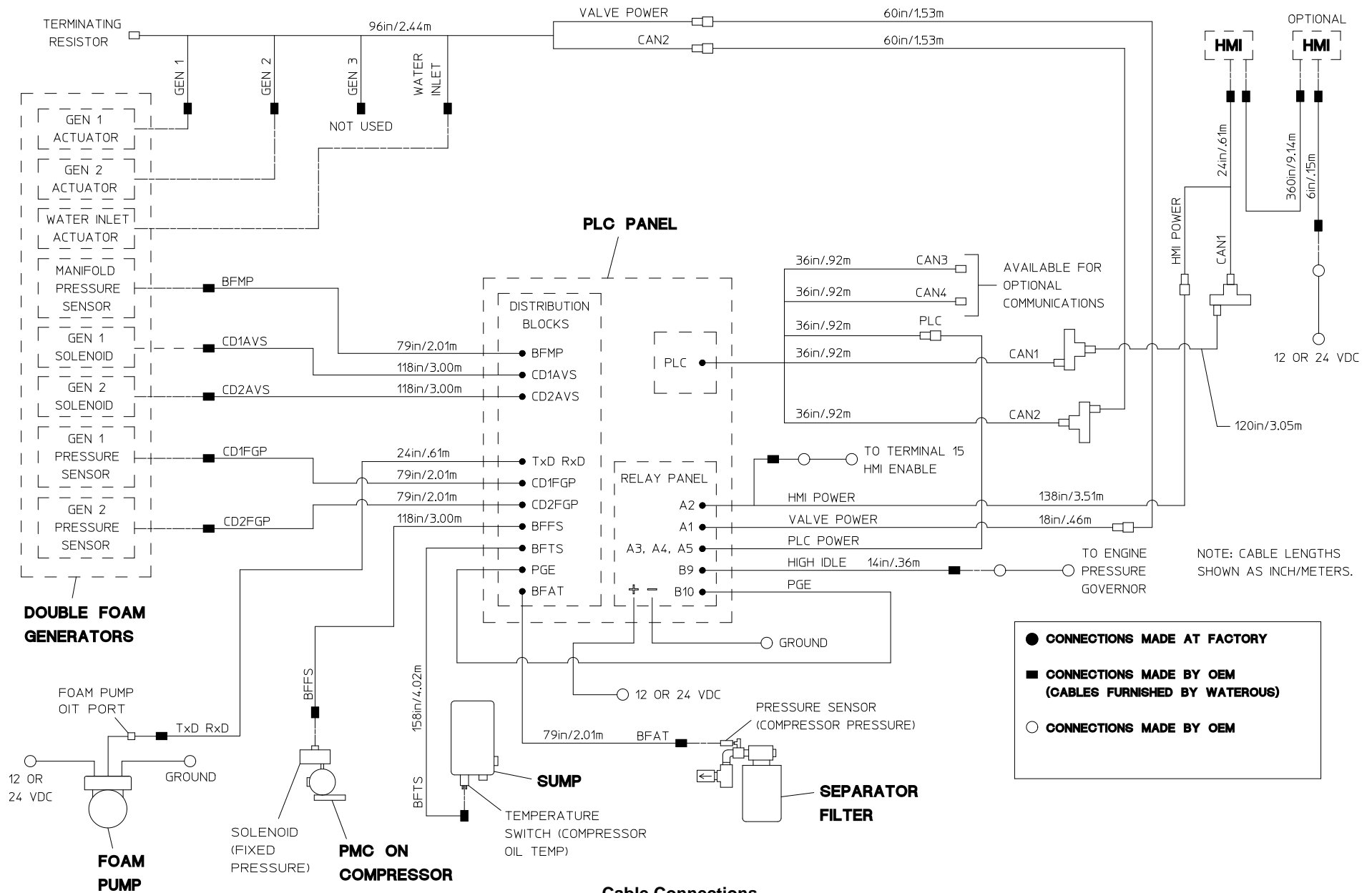
OEM Supplied Cables:

See **OEM Wiring Connections** section of this instruction.



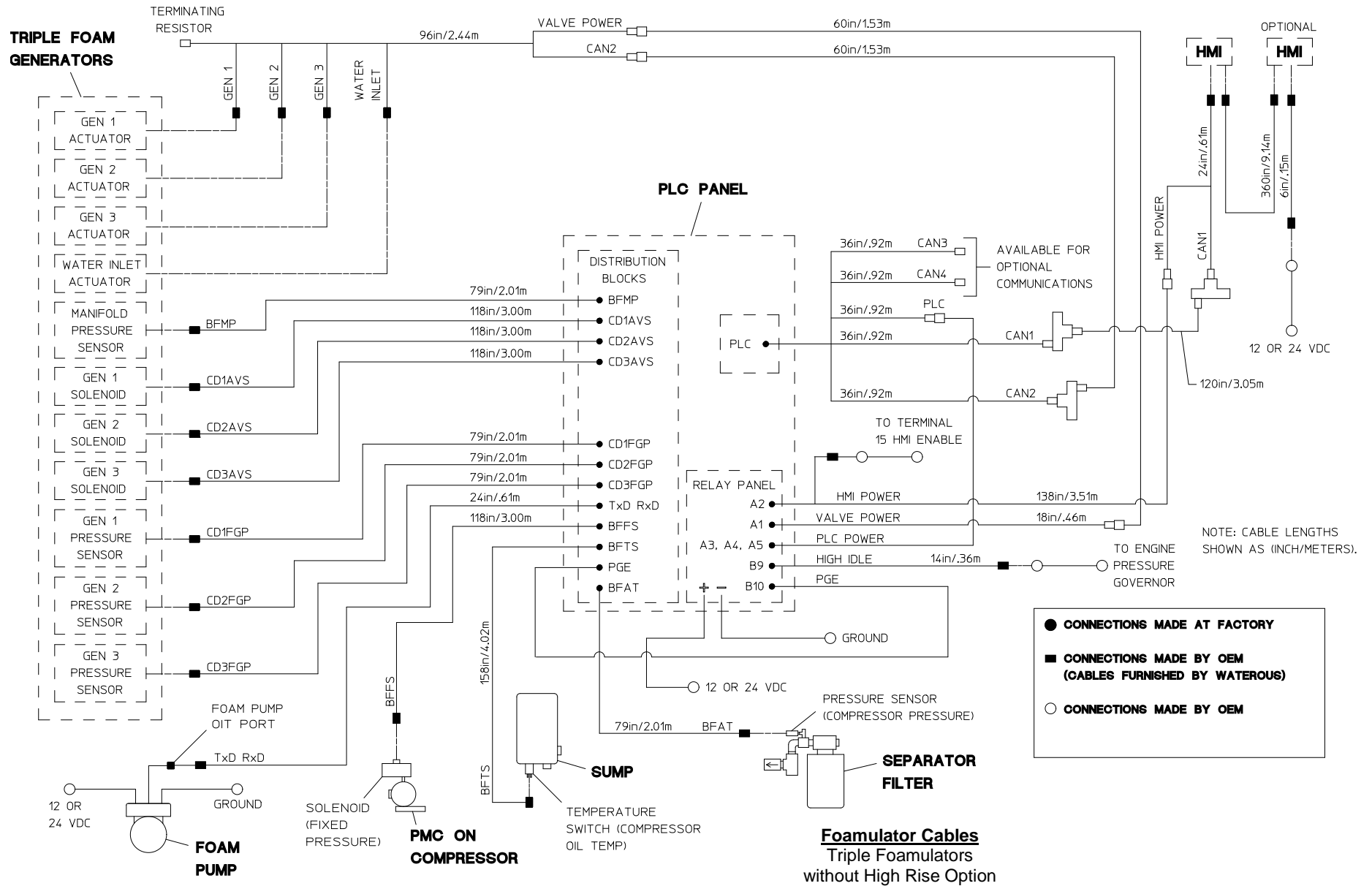
Foamulator Cables
(Triple Foamulators shown.
Foamulators 2 and 3 removed for clarity).

Installation – Double Foamulator Cable Schematic

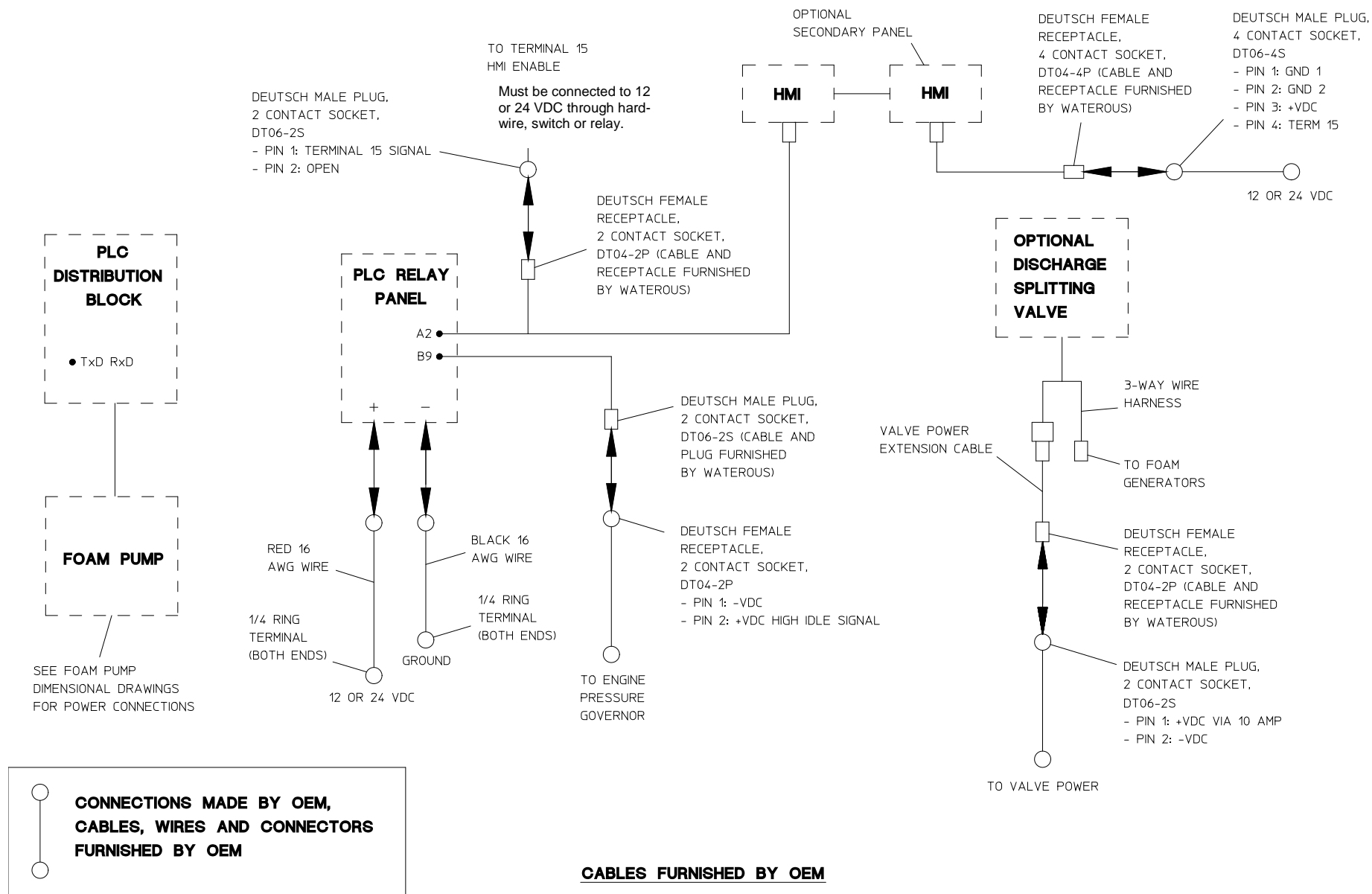


Cable Connections
Double Foamulators

Installation – Triple Foamulator Cable Schematic without High Rise



Installation – OEM Wiring Connections

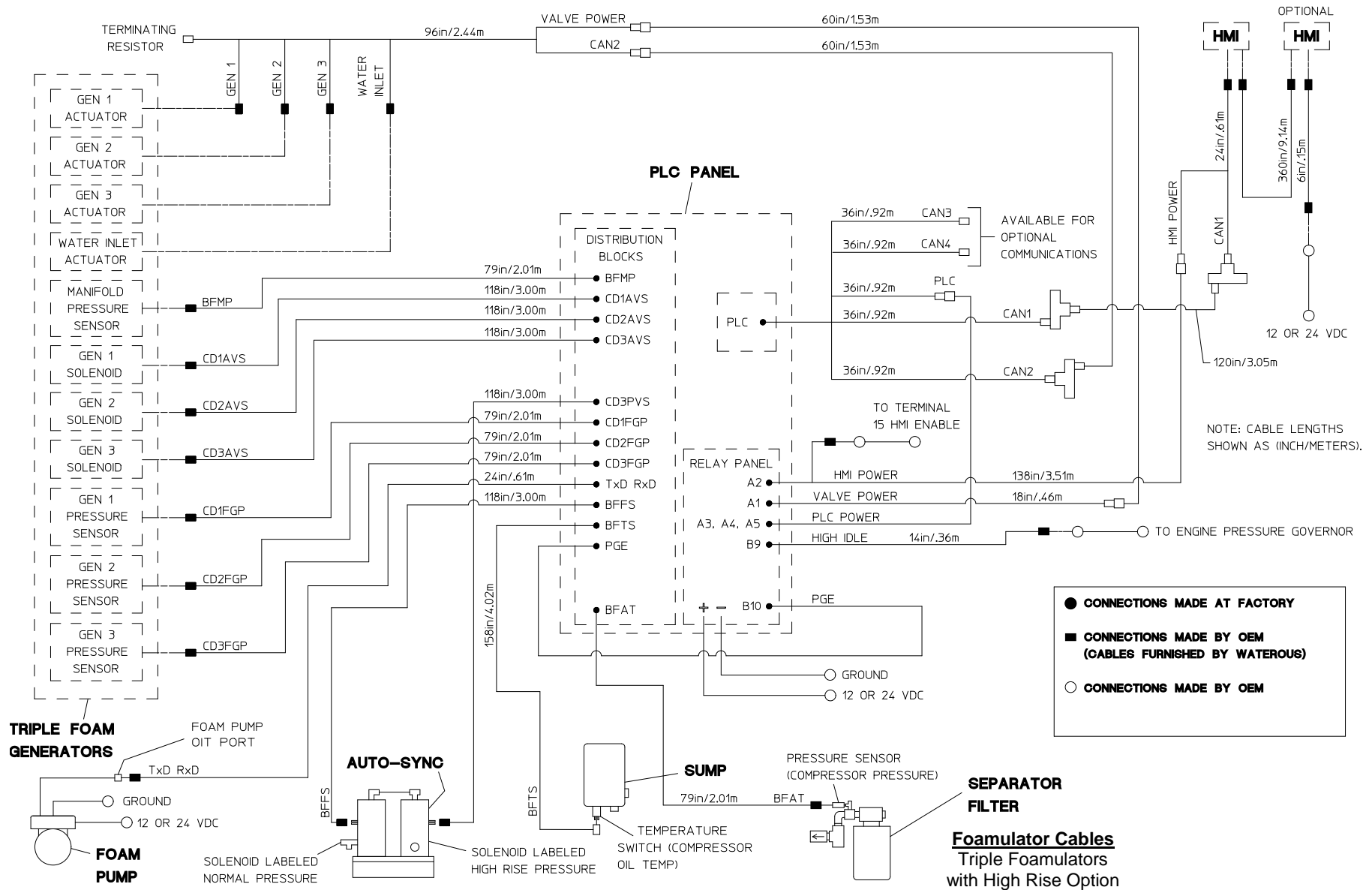


Note: For Foam Pump wiring, see separate Foam Pump installation instruction.

Optional Features – High Rise Cable Connections

Cable connections vary as follows:

Rather than a single connection to the compressor PMC, solenoid two cables are connected to the Auto-Sync solenoids.



Optional Features – Discharge Splitting Valve

3-Way Valve Installation

Location:

The splitting valve is to be located downstream from the generator discharge which is to be directed to two discharge locations.

Mounting:

When routing cables, take care to avoid routing them next to antenna cables, radio power lines and radio components.

Valve Inlet:

The inlet of valve is labeled, connect this port to the generator discharge.

Valve Discharges:

The valve discharges are labeled “A” and “B”. Note where these will be plumbed to as these locations must be identified when setting up HMI control panel.

Plumbing:

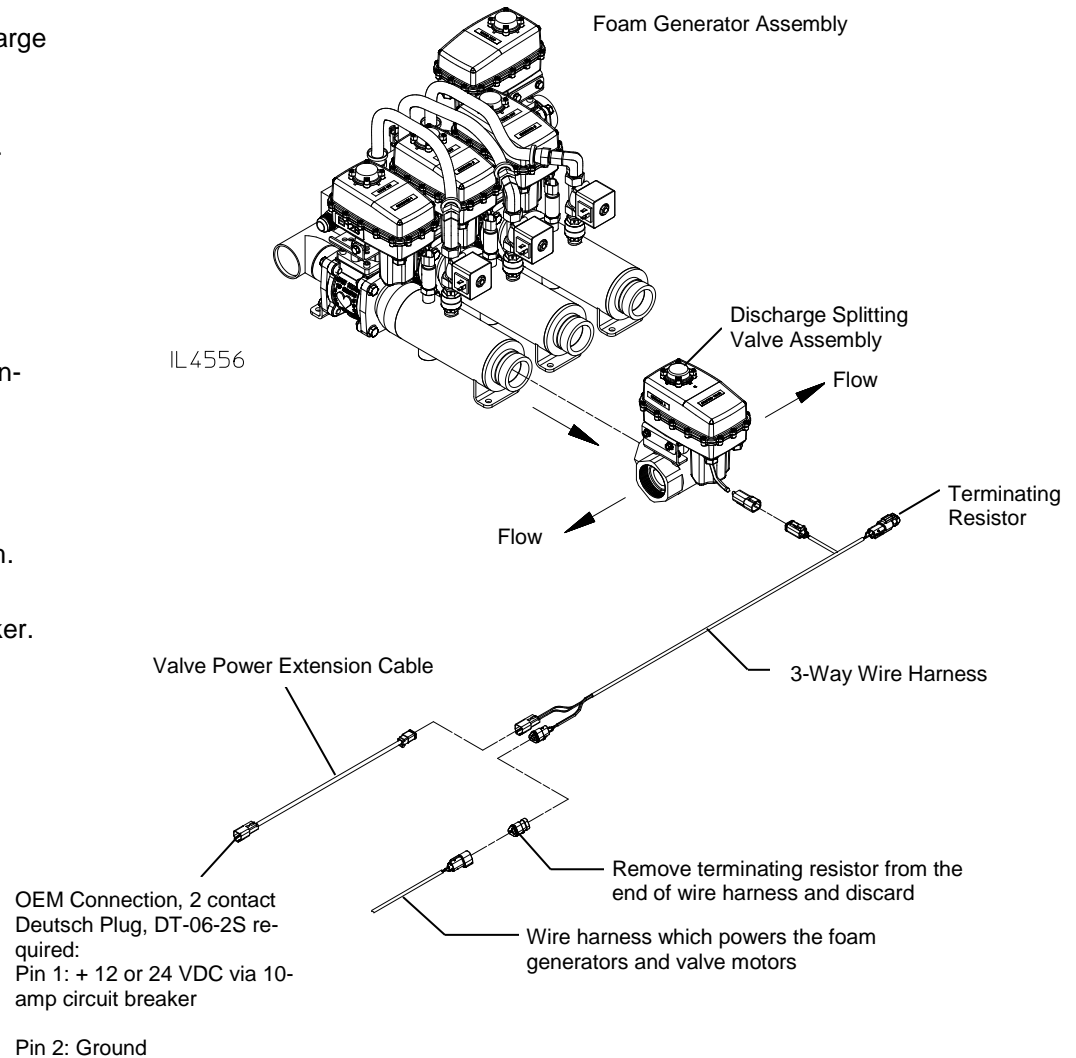
Either hard plumbing or hose may be used.

Cables Supplied by Waterous:

Install the cables furnished with Cable Kit L1209 as shown in the diagram.

OEM Connections:

Connection to apparatus power must be made via a 10-amp circuit breaker.



Set-up and Calibration – HMI Control Panel Set-up

Calibrate Eclipse GEN 2.0

1. Adjust the fixed air pressure.
2. While circulating water, expand a CAFS discharge to put the Eclipse GEN 2.0 in Fixed mode.
3. Locate the fixed pressure regulator (located on the compressor) and adjust the fixed pressure to 125 psi.
4. See Configuration Setup and Entering CAFS Configuration Mode below and complete those steps.
5. Follow the “**cal – shortcut (c)**” direction that found on page 30 of this document.
6. Follow the “**Water Flowmeter Calibrations**” directions that are found on page 32 of this document.
7. After completing step 5 and 6, calibrate the paddlewheel with a 3/4" Pitot with flows between 55 – 100 GPM.
8. Check calibration after the paddlewheel has been calibrated and the fixed pressure has been set at 125 psi in each CAFS discharge. Air volume for each discharge should be preset.
9. Fill foam tank with water with water so foam system will inject water and air into the discharges and returned to the tank through the pitot discharges.
10. A 1" tip can be put on the pitot to replicate a nozzle used with the 1-3/4" hose. While flowing in the **Wet** setting the pinch valve regulator should be adjusted, so the discharge gauge for that discharge reads about 68 psi.

Configuration Setup

1. Remove dust cap from USB port on rear of Tellurus HMI.
2. Insert USB 2.0 hub into USB port on Tellurus.
3. Insert keyboard or wireless dongle into USB port on hub.
4. If required, insert USB flash drive into hub.

Required Tools:

- USB 2.0 Hub
- USB Keyboard
- USB Flash Drive

NOTICE

Not all USB hubs are the same. Be sure the hub is rated for USB 2.0, not 1.1, 3.0 or 3.1 – these may not work properly.

TIP: A wireless USB keyboard can make connecting to the Tellurus™ unit much easier, especially when the HMI is mounted to a bulkhead or panel.

NOTE: A USB flash drive is required for Operating System upgrades, PLC updates, CAFS application updates, or for saving or restoring copies of current configuration settings. Flash drive is not required for running diagnostics, making changes to existing configurations, or calibration.

Entering CAFS Configuration Mode

Configuration mode is useful during Eclipse GEN 2.0 installation, diagnostics, and maintenance.

1. From the CAFS application screen hold down the <Alt> key and press <Tab> key to select the desired function from the desktop.
2. Release the <Alt> key and repeatedly press the <Tab> key to select the desired function from the desktop.

Available desktop functions are:

- Calibrate touchscreen
- Settings
- Terminal

Calibrate Touchscreen

The touch screen must be calibrated following any operating system firmware update or anytime the touch screen does not appear to be tracking the operators finger.

1. From the configuration desktop, select “*Calibrate Touchscreen*”.
2. Press and release on each read cross-hair as it appears in turn at each corner of the screen.

NOTE: Using a stylus will increase touch screen calibration accuracy.

Set-up and Calibration – HMI Control Panel Set-up (con't)

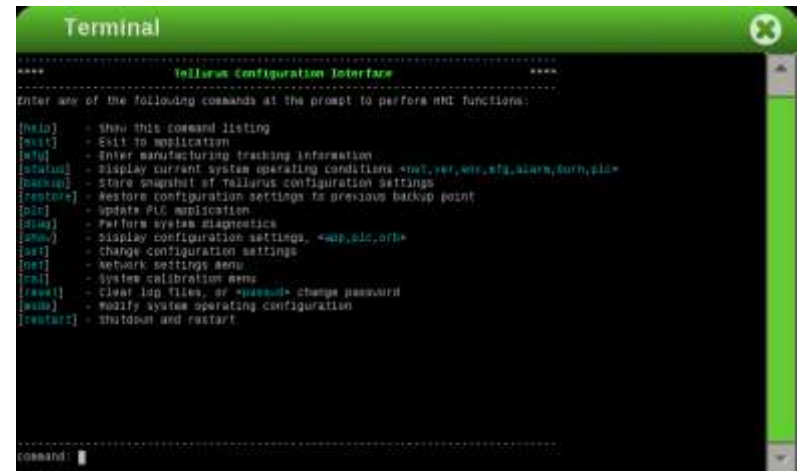
Configuration Settings

Configuration settings are accessed during installation, maintenance or diagnostics on the Tellurus unit or CAFS system.

1. From the configuration desktop select “Settings”.
2. Enter commands from the “Tellurus Configuration Interface” to perform desired configuration functions:
 - Help – shortcut (h)
 - Exit – shortcut (e)
 - Mfg – shortcut (m)
 - Status – shortcut (s)
 - Backup – shortcut (b)
 - Restore – shortcut (r)
 - PLC – shortcut (p)
 - Diag – shortcut (d)
 - Show
 - Set
 - Net – shortcut (n)
 - Cal – shortcut (c)
 - Reset
 - Mode
 - Restart

Help – shortcut (h)

Refresh Tellurus Configuration Interface command menu screen.



Exit – shortcut (e)

Exit Tellurus Configuration Interface command menu and return to the CAFS application.

Mfg – shortcut (m)

Edit or update manufacturing tracking information:

- Tellurus_SN – Serial number of Tellurus HMI top level assembly
- Carrier_Board – Serial number of base controller board
- Optical_Reset_Board – Serial number of ORB controller board
- Touch_Screen_Board – Serial number of touch screen controller board
- GPS_module – Serial number of GPS module
- Button_Board – Serial number of LED button board
- Connector_Interposer – Serial number of connector interface board
- Backlight_Driver – Serial number of backlight driver board
- LCD_Panel – Serial number of LCD display panel

Set-up and Calibration – HMI Control Panel Set-up (con't)

status – shortcut (s) (con't)

The **status** command displays a variety of different system operating parameters:

Extended status options

Burn shows historical burn-in data collected during assembly – shortcut “**s b**”

PLC shows any CANbus emergency messages logged by the PLC – shortcut “**s p**”



```
Terminal <3>
command: s # v
=====
Tellurus System Info, SN: T810034
Current configuration: production
=====
Manufacturing
Tellurus SN = T810034
Carrier_Board = 123456
Optical_Reset_Board = 123456
Touch_Screen_Board = 123456
GPS_module = 123456
Button_Board = 123456
Connector_Interposer = 123456
Backlight_Driver = 123456
LCD_Panel = 123456
Bonded_Touchscreen = 123456
Pump_SN = 123456
Customer_order = 123456
=====
version
Application version: 1.2
OS version: 10
PLC version: 4790002
=====
Press "enter" key to exit
```

Backup – shortcut (b)

A backup of the configuration files is recommended prior to making any significant changes. This provides an easy mechanism for restoring a previous configuration should the new changes be undesirable in any way.

Backup is also useful if you have multiple CAFS units that will be using the same or very similar configurations, e.g. units, discharge colors, etc. In this case a backup to a flash drive can be generated on one unit and restored on multiple other units, saving considerable time.

Step by step guide

1. Insert USB flash drive in USB hub if portable configuration is desired
2. From the Configuration Interface menu enter the command “**b**”
3. Enter unique file name for backup configuration to be stored under e.g. “*truck1*”
4. Wait for “*Configuration archive complete!*” message

TIP: Configuration files are stored on the USB flash drive in a directory named “**configuration**”. These archived configuration files can easily be copied, moved or deleted from the flash drive for your own internal record keeping.

TIP: It is good practice to create a backup configuration to a flash drive any time significant changes have been made to the configuration settings. This makes it very easy to restore the system to the exact same operating state should it ever be necessary to replace the Tellurus HMI.



```
Terminal <5>
[diag] - Perform system diagnostics
[show] - Display configuration settings, <app,plc,usb>
[set] - Change configuration settings
[net] - Network settings menu
[cal] - System calibration menu
[reset] - Clear log files, or <passwd> change password
[mode] - Modify system operating configuration
[restart] - Shutdown and restart

=====
command: b
=====
USB flash drive backup
Enter backup name: truck1

Archive backup file: truck1.tar

Archiving app_config.json
Archiving PLC_config.json
Archiving tellurus-in.json

Configuration archive complete!
```

Set-up and Calibration – HMI Control Panel Set-up (con't)

Restore – shortcut (r)

Restoring configuration files is a shortcut method to simplify the process of making numerous CAFS settings changes. Changes can be restored from any of the default options provided with the CAFS system or from any number of user generated backup configuration files.

Step by step guide

1. Insert USB flash drive in USB hub if restoring from saved backup file
2. From the Configuration Interface menu enter the command “r”
3. Select the desired configuration archive from the numbered list.
4. Wait for “*Configuration restore complete!*” message

NOTICE

As a safety mechanism, the restore command will always make a backup of the current configuration prior to updating to the newly selected configuration. This backup configuration file will show up in the configurations list using the following format:
backup_<month>_<day>_<year>

TIP: Should anything go wrong with the newly restored configuration; this auto-generated configuration backup can be restored to easily return the CAFS system to the previous state.

TIP: Waterous supplied configuration archive files or archive files created using the backup command are easily portable to any flash drive simply by copying any number of configuration files into a top level flash drive folder named “**configuration**”. The **restore** command looks for this folder automatically any time a new USB flash drive is inserted.

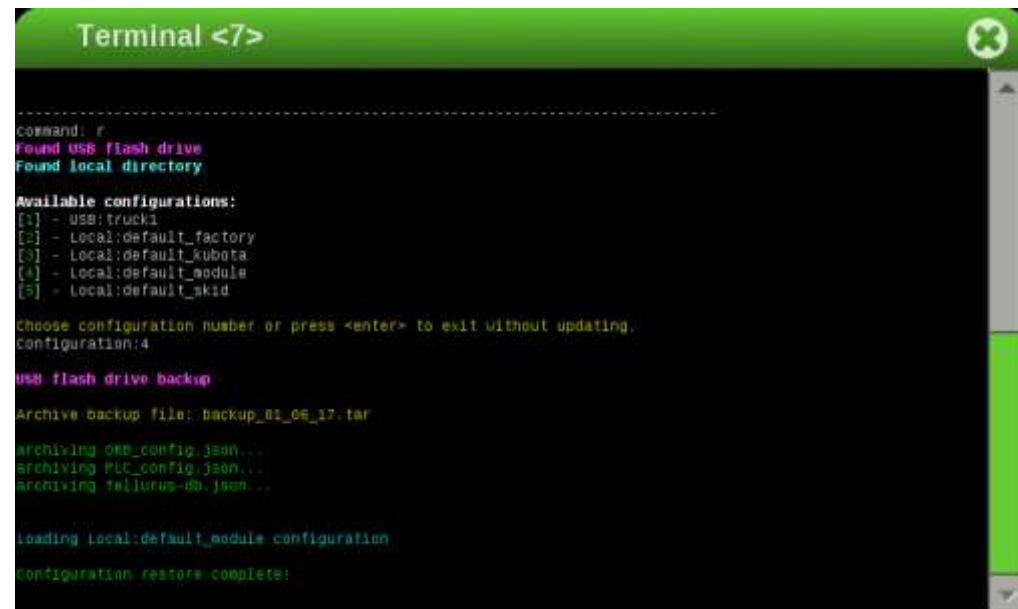
Restore – shortcut (r)

Restoring configuration files is a shortcut method to simplify the process of making numerous CAFS settings changes. Changes can be restored from any of the default options provided with the CAFS system or from any number of user generated backup configuration files.

Default CAFS configurations provided with the system include:

- **default_factory** – Generic configuration provided on every new installation
- **default_kubota** – Base configuration for Kubota gas engine powered skid systems
- **default_module** – Base configuration for stand-alone truck mounted systems
- **default_skid** – Base configuration for Deutz diesel engine powered skid systems

Configuration archives found on the inserted flash drive will be prefaced with “**USB**”.



```
Terminal <7>
-----
command: r
Found USB flash drive
Found local directory

Available configurations:
[1] - USB:truck1
[2] - Local:default_factory
[3] - Local:default_kubota
[4] - Local:default_module
[5] - Local:default_skid

Choose configuration number or press <enter> to exit without updating.
Configuration:4

USB flash drive backup
Archive backup file: backup_01_06_17.tar

archiving OHM_config.json...
archiving PLC_config.json...
archiving Tellurus-DB.json...

Loading local:default_module configuration
Configuration restore complete!
```

Set-up and Calibration – HMI Control Panel Set-up (con't)

PLC – shortcut (p)

The Programmable Logic Controller (PLC) provides the heart of the real-time CAFS control system. Adding new features or capabilities to the CAFS system may occasionally require PLC firmware upgrades. PLC firmware upgrades are enabled through the **PLC** command from the Configuration Interface menu.

The most current PLC update image is always provided locally by default with the Tellurus software. However, PLC images may also be provided independently by Waterous personnel on a USB flash drive.

Step by step guide


1. Insert USB flash drive in USB hub if restoring from Waterous provided PLC image
2. From the Configuration Interface menu enter the command “**p**”
3. Select the desired PLC image version from the “*Available PLC versions:*” list
4. Wait for “*Update successful!*” message

NOTICE

PLC updates can take several minutes. Be sure power and cable connections are not interrupted during the re-imaging process.

TIP: Waterous supplied PLC update image files are easily portable to any flash drive simply by copying any number of image files into a top level flash drive folder named “**PLC_images**”. The **PLC** command looks for this folder automatically any time a new USB flash drive is inserted.

NOTE: Listed PLC images found on the inserted flash drive will be prefaced with “**USB**”, local images will be prefaced by “**Local**”.



```
Terminal <9>

-----
command: p
Found USB flash drive
Found local directory

Available PLC versions:
[1] - local:261

Choose PLC selection number or press <enter> to exit without updating.
PLC selection:1

Establishing PLC communications...

Updating PLC with 'home\wra\Plc_images\261.hdd'.
Do not unplug PLC or remove Tellurus power until update is completed...
16386 hex file records read

-----
PILETRANSFERDONE
CHECKBOOTPROJ
RTS_START
plcupdate.c:102 slave startup, node 0x1

Update successful!
```

Diag – shortcut (d)

A number of useful system diagnostic checks are available by using the **diag** command. The results of these diagnostics checks may be requested by Waterous customer service personnel.

Header data

- Serial Number
- Ethernet Mac Address
- IP Address
- OS Version
- Application Version
- PLC Version
- ORB Version

Set-up and Calibration – HMI Control Panel Set-up (con't)

Set

The **set** command is the functional complement to the show command. Where show displays configuration settings, **set** provides a mechanism for making settings modifications.

Step by step guide

1. From the Configuration Interface menu enter the command "**set**" to enter settings mode
2. At the configuration selection "**set:**" prompt enter the starting configuration file to modify
3. Follow sub-menu prompts to make specific configuration settings changes to any number of selected values
4. Press <Enter> key to back out of each sub-menu – and ultimately exit settings mode

TIP: Use the **set** command shortcut for changing a specific value simply by entering a space separated list of sub-menus and values directly from the Configuration menu.

Example setting PLC CAFS discharge1 valve position dry = 18%, wet = 26%:

set plc cafs discharge1 18 26

Example jumping directly to all Application discharge1 sub-menu settings:

set app discharge1

TIP: The current value for each configuration setting is shown in square brackets "[<default value>]" at the settings prompt. Press the <Enter> key to keep the current value with no changes.



CAFS System Configuration Files

The CAF System uses a set of configuration files to define system operating parameters. Some parameters settings are defined by Waterous, others are defined during system integration, and still others are User defined by the truck builder or end customer. All configuration settings are visible using the show command. However, this guide will detail only User accessible settings available through the set command.

The configuration settings are broken down into 3 main component files:

- **app** - Tellurus™ HMI CAFS application configuration, e.g. units, colors, names, etc.
- **plc** – Programmable Logic Controller (PLC) configuration, e.g. wet/dry set points, foam presets, etc.
- **orb** – Optical Reset Button (ORB) configuration, ambient background adjustment.

Set-up and Calibration – HMI Control Panel Set-up (con't)

Application Configuration

The Application Configuration file defines Tellurus HMI CAFS application settings, e.g. units, colors, names, etc. All user accessible settings are defined in the following hierarchical sub-menu structure and may be changed using the set command.

- **all** – Sequentially walk through all Application Configuration settings
- **language** – Set display language for controls

Select display language: en=English, de=German, fr=French, es=Spanish, zh=Chinese, pt=Portuguese, ru=Russia, it=Italian

Select language from the following list:

- [1] – “default”
- [2] – “en-US”
- [3] – “de-DE”
- [4] – “fr-FR”
- [5] – “es-ES”
- [6] – “zh-CN”
- [7] – “pt-PT”
- [8] – “ru-RU”
- [9] – “it-IT”

NOTE: Not all languages translations are fully implemented. If you wish to use a language not listed or make changes to an existing translation, please contact Waterous customer service.

- **discharge1-3** – Set discharge colors and displayed names for each of the discharges
 - **color** – Choose discharge color in hexadecimal RGB format, e.g. orange=f9a01b

TIP: If unsure of the proper hexadecimal color, several online resources are available, e.g. <http://www.colorpicker.com>

- **name** – Select name for discharge

NOTE: Long names may be truncated on the applications screen and abbreviations may be necessary.

- **gauge** – Configure scale, units, warning, and alarm levels for each gauge type.

Application Configuration (con't)

NOTE: All gauge range and scale configuration parameters are in units of PSI, RPM, °F, US GAL, and US Gallons per minute (GPM). These range units are independent of the displayed units shown in the application which can be of any user desired type.

- **airpressure** – Air pressure gauge
 - **highalarm** – Select air pressure high alarm level in PSI
 - **highwarning** – Select air pressure high warning level in PSI
 - **lowwarning** – Select air pressure low warning level in PSI
 - **max** – Select maximum air pressure in PSI to display on gauge
 - **min** – Select minimum air pressure in PSI to display on gauge
 - **units** – Choose display units for air pressure:
PSI=pounds per square inch, BAR=bar, KPA=kilopascal

Select units from the following list:

- [1] – “PSI”
- [2] – “BAR”
- [3] – “KPA”

- **enginespeed** – Engine tachometer gauge (skid units only)
 - **max** – Select maximum engine speed in RPM to display on gauge.
 - **min** – Select minimum engine speed in RPM to display on gauge.
- **oiltemperature** – Oil temperature gauge
 - **highalarm** – Select oil temperature high alarm level in °F.
 - **highwarning** – Select oil temperature high warning level in °F.
 - **lowalarm** – Select oil temperature low alarm level in °F.
 - **max** – Select maximum oil temperature in °F to display on gauge.
 - **min** – Select minimum oil temperature in °F to display on gauge.

Set-up and Calibration – HMI Control Panel Set-up (con't)

Application Configuration (con't)

NOTE: All gauge range and scale configuration parameters are in units of PSI, RPM, °F, US GAL, and US Gallons per minute (GPM). These range units are independent of the displayed units shown in the application which can be of any user desired type.

- **units** – Set display units for flow, pressure, temperature and volume
 - **flow** – Choose units for water and foam flow:
GPM=gallons per minute, LPM=liters per minute,
IGM=Imperial Gallon per minute
Select units from the following list:
[1] – “GPM”
[2] – “LPM”
[3] – “IGM”
 - **pressure** – Choose units for water pressure: PSI=pounds per square inch, BAR=bar, KPA=kilopascal
Select units from the following list:
[1] – “PSI”
[2] – “BAR”
[3] – “KPA”
 - **temperature** – Choose temperature units: °F=Fahrenheit
°C=Celsius
Select units from the following list:
[1] = “F”
[2] = “C”
 - **volume** – Choose units for water and foam volume:
GAL=gallons, L=liters, IG=Imperial Gallons
Select units from the following list:
[1] = “GAL”
[2] = “L”
[3] = “IG”
- **waterflow** – Set range for water flow gauge
 - **max** – Select maximum water flow in GPM to display on gauge.
 - **min** – Select minimum water flow in GPM to display on gauge.
- **waterpressure** – Set range for water pressure gauge
 - **max** – Select maximum water pressure in PSI to display on gauge.

- **min** – Select minimum water pressure in PSI to display on gauge.

Optical Reset Button (ORB) Configuration

The ORB Configuration file defines Tellurus HMI optical reset button settings. The only user adjustable setting is the brightness adjust mode and may be changed using the set command:

- **all** – Select brightness adjust mode, fixed brightness, auto-adjust
Select autoBright from the following list:
[1] – fixed
[2] – auto

Note: **Fixed** brightness will keep the display brightness at the highest level under all conditions.

Auto brightness will adjust the display brightness to dim the display for nighttime or in-cab use.

Programmable Logic Controller (PLC) Configuration

The ORB Configuration file defines Tellurus HMI optical reset button settings. The only user adjustable setting is the brightness adjust mode and may be changed using the set command:

- **all** – Sequentially walk through all PLC Configuration settings
- **cafs** – Set wet/dry CAFS settings for each discharge
 - **discharge1-3**
 1. *dry* – Select Discharge dry preset valve position %
 2. *wet* – Select Discharge wet preset valve position %

Set-up and Calibration – HMI Control Panel Set-up (con't)

Programmable Logic Controller (PLC) Configuration (con't)

The ORB Configuration file defines Tellurus HMI optical reset button settings. The only user adjustable setting is the brightness adjust mode and may be changed using the set command:

- **foam** – Adjust foam system parameters
 - **type** – Proportioner: 1=Aquis, 2=Avantus, 3=V-MUX, 4=Waterous CANopen
Select proportionerType from the following list:
[1] – Aquis
[2] – Advantus
[3] – V-MUX
[4] – Waterous CANopen

- **pld** – Set closed loop control parameters

Note: Improper PID control loop settings can leave the CAFS system inoperable. Do not make changes to these settings without first consulting with trained Waterous customer service personnel.

- **manifold** – Manifold valve control loop settings
 1. *manifoldKp* – Manifold pressure coefficient Kp
 2. *manifoldKi* – Manifold pressure coefficient Ki
 3. *manifoldKd* – Manifold pressure coefficient Kd
- **engine** – Engine throttle control loop settings (skid unit only)
 1. *engineSpeedKp* – Engine speed coefficient Kp
 2. *engineSpeedKi* – Engine speed coefficient Ki
 3. *engineSpeedKd* – Engine speed coefficient Kd
- **pressure** – Adjust manifold and pump pressure setpoints
 - **manifold** – Manifold pressure setpoint in psi
 - **pump** – Pump pressure setpoint in psi (skid units only)

Programmable Logic Controller (PLC) Configuration (con't)

- **system** – General PLC configuration settings
 - **air** – Prevent air inject: ALLOW air inject, PREVENT air inject
Select preventAirInject from the following list:
[1] – ALLOW air inject
[2] – PREVENT air inject
type – Choose system type
Select skid_module from the following list:
[1] – skid
[2] – module
[3] – module, discharge 3 monitor
[4] – Kubota skid

Note: The system type must match the actual CAFS system hardware.

- **counters** – Set warning actuation count thresholds for throttle and valve actuators
 - **throttle** – Throttle actuations before reporting maintenance warning
 - **valve** – Valve actuations before reporting maintenance warning
- **discharge** – Set number and type of discharges
 - **3-way** – Set monitor and discharge valve positions (discharge 3 monitor systems only)
 1. *Mon3WayValvePosn* – Valve position for monitor, % open
 2. *Dis3WayValvePosn* – Valve position for discharge, % open
 - **count** – Select number of available discharges

Set-up and Calibration – HMI Control Panel Set-up (con't)

Net – shortcut (n)

The **net** command opens the Tellurus Network Configuration Interface menu. This menu configures wireless network configuration for connection to remote smart devices e.g. WiFi, smart phone hotspot, etc.

Current Settings

The header information displays the current WiFi settings:

- **wifi zone** – Network name to use when connecting from remote device
- **password** – WPA2 network encryption password
- **zone** – State of wireless zone when searching from remote device, i.e. *visible or invisible*
- **wifi state** – Local device connection, *hotspot mode*, or remote connection, *client mode*

Commands

- **help** – Refresh the menu
- **exit** – Exit network menu and return to main Configuration Settings menu
- **show** – Make Wifi **Zone** visible to remote devices
- **hide** – Make Wifi **Zone** invisible to remote devices
- **hotspot** – Change WPA2 network hotspot **Password**
- **zone** – Change Wifi **Zone** name

Tip: To avoid confusion, it is recommended to use a **Zone** name that clearly identifies the specific CAFS apparatus.

Tip: Good security practice for preventing unauthorized access is to hide the **Zone** name and use a non-trivial **hotspot Password**

Note: One connected from a remote device to the local Tellurus Wifi network, the CAFS application is accessible via web browser at IP address:
192.168.1.1

Cal – shortcut (c)

The **cal** command opens the Tellurus Calibration menu. This menu provides access to several configuration wizards that can help simplify system setup and maintenance:

- CAFS valve wet/dry flow calibration
- Clear maintenance counters
- Water flowmeter calibration

Tip: help – shortcut (h) – Refreshes the command listing

exit – shortcut (e) – Returns to the main Configuration Settings menu



Set-up and Calibration – HMI Control Panel Set-up (con't)

CAFS valve wet/dry flow calibration

CAFS valve wet/dry flow calibration automates the process of adjusting the discharge valve position to account for plumbing differences and variations in discharge sizes.

Step by step guide

1. Verify the **System** type listed in the header matches the apparatus installation. If not, enter the correct system type using the set plc system type command from the Configuration Settings menu.
2. Select the **Discharge** number for valve calibration using the **dis-charge** command – shortcut “**d**”
Example: **d 2** (*selects discharge #2*)
3. Choose discharge **Hose Size** using the **size** command – shortcut “**s**”
Example: **s 1.75** (*sets discharge size to 1.75*)
4. Set **dry** or **wet** calibration **Setting Type** by entering the **dry** or **wet** command
Example: **wet** (*selects wet calibration*)
5. Adjust the **Flow Deadband** to control calibration accuracy using the **band** command – shortcut “**b**”
Example: **b 5** (*stop calibration at +5 gpm/-0 gpm from Target Flow*)
6. On a module based system, activate the pump preset on the pressure governor to bring the manifold pressure up to the CAFS operating point.
7. Start the calibration loop by entering the **cal** command – shortcut “**c**”
8. Follow the on-screen instructions until the calibration cycle is complete

NOTICE

For accurate calibration, water flowmeter must be calibrated and air pressure must be manually adjusted prior to wet/dry flow calibration.

Tip: If the calibration loop is unable to hit the Target Flow within a few tries it may time out. In this case, it may be necessary to open up the Flow Deadband using the **band** command.

Tip: help – shortcut (h) – Refreshes the command menu list

exit – shortcut (e) – Exit CAFS calibration back to Calibration menu

refresh – shortcut (r) – Update header value readings from PLC

Set-up and Calibration – HMI Control Panel Set-up (con't)

Clear maintenance counters

The maintenance counters monitor the actuator life of the throttle and manifold valve. Clearing these counters is necessary any time the actuator is replaced or repaired. The current counter values are displayed in the menu header.

Command listing

- **help – shortcut (h)** – Refreshes command menu list
- **exit – shortcut (e)** – Exit CAFS calibration back to Calibration menu
- **refresh – shortcut (r)** – Update header value readings from PLC
- **manifold – shortcut (m)** – Reset manifold maintenance counter
- **throttle – shortcut (t)** – Reset throttle maintenance counter

Note: When a maintenance counter exceeds the threshold value the following informational warnings will be displayed in the CAFS application:

throttle counter – “**throttle actuator maintenance required**”

valve counter – “**manifold valve maintenance required**”

Tip: Thresholds for throttle and valve maintenance counter warnings can be set from the Configuration Settings menu using the **set plc system counters command**.

Note: If a maintenance counter threshold is exceeded, test and/or replace selected actuator before resetting the associated maintenance counter.



Water flowmeter calibration

Accurate water flow measurement is critical to the proper functioning of CAFS. Paddlewheel flowmeter calibration is accomplished using an external calibrated measurement gauge, e.g. magnetic flowmeter, pitot tube, etc. to establish a target flow. This target is used as a reference point for calibration of the paddlewheel.

Step by step guide

1. Make sure engine is running and speed is adjusted to provide adequate pump pressure. For skid units, the **speed** command can be used to ramp up the engine rpm – shortcut “**s**”
Example: **s 2800** (ramp engine speed to 2800 rpm, skid units only)
2. Open selected valve(s) to establish water flow using the valve command – shortcut “**v**”
Example: **v 1 75** (open discharge #1 valve to 75%)
3. Measure actual discharge water flow in US Gallons per minute using external calibrated meter. Use the **target** command to enter the measured value as the flow target – shortcut “**t**”
Example: **t 73** (set **Target Flow** to 73 gpm)
4. Enter **cal** command to initiate flowmeter calibration – shortcut “**c**”
5. Follow the on-screen instructions until the calibration cycle is complete

Tip: Once calibrated, use the **refresh** command to verify the **Current Flow** matches the measured **Target Flow**.

Note: **help – shortcut (h)** – Refreshes command menu list

exit – shortcut (e) – Exit CAFS calibration back to Calibration menu

refresh – shortcut (r) – Update header value readings from PLC

Tip: If multiple discharges are opened to establish the desired water flow the **Target Flow** will be the sum of the flow from each discharge

Note: Flowmeter will be most accurate at the calibration point, so it is best to establish a water flow that most closely represents the normal CAFS operating range when calibrating.

Set-up and Calibration – HMI Control Panel Set-up (con't)

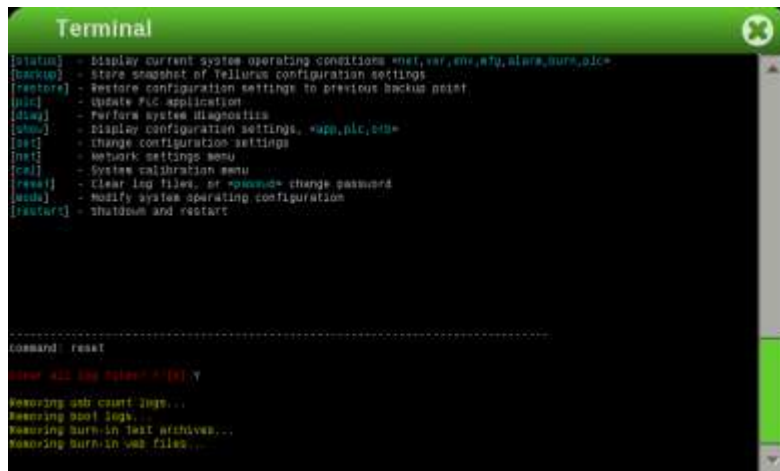
reset

The reset command is intended for use during remote diagnostics by trained Waterous customer service personnel.

Command listing

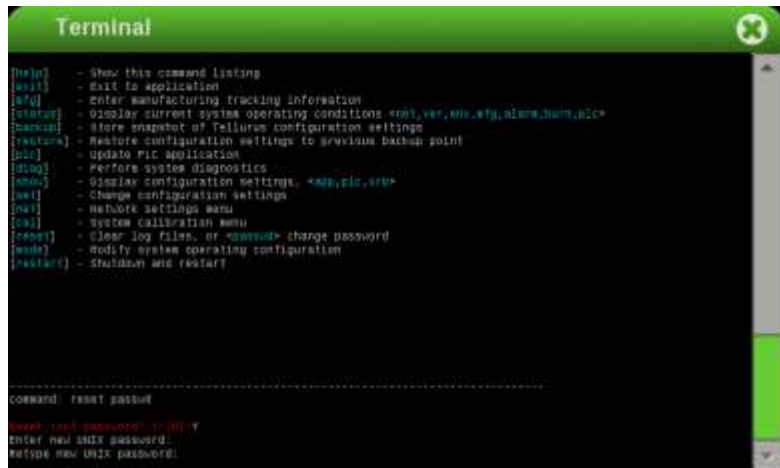
- **reset** – Clear diagnostic log files to help with remote troubleshooting
- **reset passwd** – Temporarily modify the root password to allow for remote access by trained Waterous customer service personnel

Note: After resetting the password will be changed again to a new random value on the next restart or power cycle



```
Terminal
[status] - Display current system operating conditions <net,ver,ens,efg,alarm,hum,plc>
[backup] - Store snapshot of Tellurus configuration settings
[restore] - Restore configuration settings to previous backup point
[plc] - Update PLC application
[diag] - Perform system diagnostics
[show] - Display configuration settings, <app,plc,ens>
[set] - Change configuration settings
[net] - Network settings menu
[cal] - System calibration menu
[reset] - Clear log files, or <passwd> change password
[mode] - Modify system operating configuration
[restart] - Shutdown and restart

-----
Command: reset
Enter old log network ID: Y
Removing web count logs...
Removing boot logs...
Removing burn-in test archives...
Removing burn-in web files...
```



```
Terminal
[help] - Show this command listing
[exit] - Exit to application
[efg] - Enter manufacturing tracking information
[status] - Display current system operating conditions <net,ver,ens,efg,alarm,hum,plc>
[backup] - Store snapshot of Tellurus configuration settings
[restore] - Restore configuration settings to previous backup point
[plc] - Update PLC application
[diag] - Perform system diagnostics
[show] - Display configuration settings, <app,plc,ens>
[set] - Change configuration settings
[net] - Network settings menu
[cal] - System calibration menu
[reset] - Clear log files, or <passwd> change password
[mode] - Modify system operating configuration
[restart] - Shutdown and restart

-----
Command: reset passwd
Enter new password: Y
Enter new UNIX password:
Retype new UNIX password:
```

mode

The Tellurus HMI has several global modes that affect the system operating environment. These environment modes simplify operation of the Tellurus for simulation, testing, single display, and dual display configurations. Normal production modes are accessed from the Configuration Settings menu using the **mode** command.

Step by step guide

1. **Normal stand-alone HMI mode** – This is the standard mode for any system with a single Tellurus display.
2. **Dual-display primary HMI mode** – This is the mode setting used for the main display in any dual display Tellurus system.
3. **Dual-display secondary HMI mode** – This is the mode setting used for the secondary display in any dual display Tellurus system.

Note: In any Tellurus dual-display system one display must be configured in **primary mode** and the second display must be configured in **secondary mode**.

Other operating modes are available, but used only during Waterous assembly and testing. These modes are only accessible directly from the Configuration Settings menu and should not be used in a functioning CAFS system:

- **mode simulator** – Operates the CAFS application in a non-functioning state using simulated data without need for a PLC
- **mode burnin** – Runs the system diagnostics in a stress test environment used during manufacturing

restart

The **restart** command is accessible from the Configuration Settings menu and provides a simple way to cycle power on the Tellurus HMI without need to toggle any external master switch.

Terminal Mode

Terminal mode provides direct access to the Tellurus Operating System.

Step by step guide

1. From the Configuration Desktop select "*Terminal*"
2. **Dual-display primary HMI mode** – This is the mode setting used for the main display in any dual display Tellurus system.

NOTICE

Terminal mode should only be used by advanced users under technical direction of trained Waterous personnel.

Improper use of Terminal Mode can leave your CAFS system and/or Tellurus display in an inoperable state.

PLC Alarm Conditions

1. Compressor oil high temperature
2. Manifold pressure alarm
3. Valve communication fault
4. Valve position fault
5. Throttle position fault
6. Pressure fault on discharge #1
7. Foam concentrate low
8. Foam concentrate empty
9. Foam system communication fault
10. Foam system high capacity limit
11. Foam system low capacity limit
12. Pressure fault on discharge #2
13. Manifold valve maintenance required
14. Throttle actuator maintenance required
15. Solenoid open fault
16. Solenoid short fault
17. Analog sensor fault
18. Pressure fault on discharge #3
19. Air pressure alarm
20. Pump pressure alarm
21. Engine speed alarm
22. Water calibration fault
23. CAFS unload alarm
24. Undefined Error 2
25. Undefined Error 3
26. Undefined Error 4
27. Undefined Error 5
28. Undefined Error 6
29. Undefined Error 7
30. Undefined Error 8
31. PLC configuration error
32. CANbus communications fault

Troubleshooting Guide

CAFS

Problem	Probable Cause	Recommended action
Compressor not engaging	No PTO engagement	Confirm OK TO PUMP light is on, if not check wiring for damage r disconnected wire, check PTO.
Compressor engaging. No air supply to discharges or insufficient air supply	Verify there is power to the air generator solenoid and check operation of solenoid.	Air generator solenoid not working. Repair/replace solenoid. Air solenoid working – leak between solenoid and discharge. Repair leak.
	Air check valve defective	Replace or correct installation.
	Trim valve on compressor inlet valve out of adjustment	Refer to trim valve instructions
	Restricted minimum pressure valve	Clean rust or debris from valve
	Air plumbed before discharge valve seal	Relocated to discharge side of discharge valve
	Incorrect air line size	Size according to discharge and replace line with correct size.
System functioning correctly, pressure gauge reading obviously incorrect.	Pressure transducer malfunction, air line detached	Check for air leaks, replace pressure transducer
Air discharge pressure too high	Red hose circuit (compressed air control) has leaked or is disconnected.	Repair leak or attach hose

Troubleshooting Guide

CAFS (Continued)

Problem	Probable Cause	Recommended action
System overheating	Inadequate water flow through cooler	Ensure adequate water flow through pump. Check Wye-Strainer for obstruction, clean and reinstall Drain and flush cooler water tubes.
	Adequate water flow through cooler	On-board tank used for cooling for a prolonged period – water too hot to effectively cool the compressor. Locate source of lower temperature water. Check oil level – adjust level to half of the sight glass on level surface
	Low compressor oil level	Check the hydraulic lines for kinks, change oil filters
	Temperature sending unit and/or gauge circuit malfunction	Check wire connections at sending unit
High Oil Consumption	Overfull compressor oil	Adjust level to half of the sight glass on level surface
	Exceeding air flow rated capacity	Back down RPM's and flow CAFS to relieve pressure, then re-check. Replace Air/Oil Separator Filter
	Air/Oil Separator Filter damaged (could be caused by air flow of higher than rated capacity)	System being operated at higher than capacity
"Excessive" compressor bleed down time on shutoff	Systems vary in bleed down time	If PMC is operating correctly, and compressor output is within spec, do nothing.
Engine stalls upon compressor engagement	Engaging compressor while under load	Allow compressor to bleed down before re-engagement
	Running system without flowing air causes oil to accumulate in compressor acting like hydraulic pump	Bleed down air, restart compressor, and move air
	Underrated engine horsepower	Raise engine RPM
	High oil level	Check oil level, adjust level to half of the sight glass with vehicle parked on a level surface
	Compressor locked up	Repair/replace compressor
Compressor locked up	High oil level (compressor is flooded)	Check oil level, adjust level to half of the sight glass with vehicle parked on a level surface
	Sump fire	Check system and repair
	Low oil level or no oil	Check system and repair
Safety pop off valve repeatedly opening	Trim valve or compressor inlet completely open	Refer to trim valve instructions

Troubleshooting Guide

CAFS (Continued)

Problem	Probable Cause	Recommended action
Poor foam (wet or dry) or no foam (assuming air pressure to discharges is OK)	Using wetting agent and not foam concentrate	Ensure adequate water flow through pump. Check Wye-Strainer for obstruction, clean and reinstall Drain and flush cooler water tubes.
	Foam proportioning control turned too low	Use foam concentrate
	Foam proportioning control OFF or turned too low, foam tank empty.	Make sure proportioner is turned on, foam supply valve is open, foam tank has concentrate, Wye-Strainer is clean, and supply line is connected to injector
Discharge hose shaking (slug flow)	Foam proportioner ON, setting correct, and tank has foam concentrate, but not providing foam solution	Refer to foam proportioner manufacturer's instructions for detailed calibration and troubleshooting instructions
Foam in the water system (when proportioner turned off)	Foam concentrate was poured into the on-board water tank	Flush tank and pump with clean water, refill
	Foam manifold drain lines not isolated from water drain lines	Isolate to separate drain valve
	Cooler line plumbed from manifold	System being operated at higher than capacity
	Foam manifold check valve defective	Rebuild/replace check valves
Water in compressor oil/air	Leaking inside cooler Freeze damage	Isolate cooler and check for leaks, replace if needed, check drain
	Defective air check valve	Replace or check
	Missing air check valves for discharges	Install check valves
Safety pop off valve opening at low pressure	Trim valve on compressor inlet valve out of adjustment	Adjust the Trim Valve, making sure to not open the trim valve on the compressor more than 3 turns
	Sump fire damaged pop off valve	Check system for other damage and replace valve.

Troubleshooting Guide

Eclipse GEN 2.0™ Panel

Problem	Probable Cause	Recommended action
Compressor oil high temperature	Air compressor oil temperature is outside its alarm. The default is to check only the high alarm value at 235°F	Oil level in the air compressor is low = Check for oil leaks and repair is needed. Use ISO 68 viscosity hydraulic oil, filling to the middle of the sight glass.
		Plugged water strainer at oil cooler = Remove strainer and clean screen
		Inadequate water supply = Verify that water is being circulated within the pump (TANK TO PUMP valve completely open with the TANK FILL valve 1/4 open).
		Overheated water supply = Supply the pump with fresh cool water and open a discharge valve or TANK FILL valve, allowing the heated water to be dumped to atmosphere.
Manifold Pressure Alarm	The manifold pressure is outside its alarm limits when CAFS is active.	The pressure in the manifold is below 75 psi (5 bar). Increase pump pressure to 125 psi (8.5 bar).
Valve Communication Fault	No communication from a J1939 device for 500 ms. The J1939 devices are discharge valves, the manifold valve, the monitor 3-way valve, and the engine throttle.	Check for disconnected PLC harness to valves or throttle.
Valve Position Fault	A valve is not at its commanded position. Discharge valves, the manifold valve, and the monitor 3-way valve are covered by this alarm.	Valve actuator is operating out of operating variance and needs to be replaced.
Throttle Position Fault	The engine throttle is not at its commanded position.	Throttle actuator is operating out of its operating variance and needs to be replaced.
Pressure fault on discharge #1. Pressure transducer on discharge #1 is not reading	Transducer is either unplugged or faulty.	Re-connect or replace transducer
Foam concentrate low	The foam proportioner has a low concentrate condition and foam proportioner will shut off.	Foam concentrate tank needs to be filled. Also check for faulty level switch if tank is full.
Foam concentrate empty	The foam proportioner has a no concentrate condition. Foam proportioner will not turn on.	Foam concentrate tank needs to be filled. Also check for faulty level switch if tank is full.
Foam system communication fault	The PLC cannot communicate with the foam proportioner. No communication with foam proportioner due to disconnected cable, faulty TxD/RxD or foam proportioner driver has no power.	Power foam proportioner, reconnect cable or replace TxD/RxD.
Foam system high capacity limit	The foam proportioner has a high flow condition. Operator flowing more water through foam manifold than can be treated by foam proportioner at the selected percentage.	Reduce flow or injection percentage.

Troubleshooting Guide

Eclipse GEN 2.0™ Panel (Continued)

Problem	Probable Cause	Recommended action
Pressure fault on discharge #2. Pressure transducer on discharge #2 is not reading.	Transducer is either unplugged or faulty.	Re-connect or replace transducer.
Manifold valve maintenance required	The number of manifold valve activations has exceeded its lifetime. The lifetime is currently set to 250000	Replace manifold valve actuator or increase lifetime actuation cycles.
Throttle actuator maintenance required	The number of throttle activations has exceeded its lifetime. The lifetime is currently set to 500000.	Replace throttle actuator or increase lifetime actuation cycles.
Solenoid open fault	A solenoid is active but is drawing too little current indicating an open fault. Solenoids covered are air discharge valve, fixed air pressure, pressure governor.	Check wiring/connections or replace solenoid.
Solenoid short fault	A solenoid is active and is drawing too much current indicating a short. Solenoids covered are air discharge valve, fixed air pressure, pressure governor.	
Analog sensor fault	The A/D counts for a temperature or pressure sensor is close to zero indicating a disconnected sensor.	Check for disconnected sensor and re-connect.
Pressure fault on discharge #3. Pressure transducer on discharge #3 is not reading.	Transducer is either unplugged or faulty.	Re-connect or replace transducer.
Air pressure alarm	The air pressure is outside its alarm limits when the fixed air solenoid is active. The default is to check only the low alarm value at 75 psi.	Check fixed air solenoid connections and fixed pressure regulator function.

Troubleshooting Guide

Eclipse GEN 2.0™ Panel (Continued)

Problem	Probable Cause	Recommended action	
CAFS unload alarm	With CAFS active, the air compressor was unloaded because the oil temperature was too high. This may have happened because a) the oil temp exceeded 265°F, or b) the oil temp exceeded the high action limit and the operator did not acknowledge the alarm. The high action alarm limit defaults to 260°F.	Resort to foam solution fire-fighting tactics and correct overheat with: oil level in the air compressor is low	Check for oil leaks and re-pair as needed. Use ISO 68 viscosity hydraulic oil, filling to the middle of the sight glass.
		Resort to foam solution fire-fighting tactics and correct overheat with: Plugged water strainer at oil cooler	Remove strainer and clean screen.
		Resort to foam solution fire-fighting tactics and correct overheat with: Inadequate water supply	Verify that water is being circulated within the pump (TANK TO PUMP valve completely open with the TANK FILL valve 1/4 open).
		Resort to foam solution fire-fighting tactics and correct overheat with: Overheated water supply	Supply the pump with fresh cool water and open a discharge valve or TANK FILL valve, allowing the heated water to be dumped to atmosphere.
Joystick unresponsive (if equipped)	The PLC is not receiving data from the monitor joystick.	Check wiring/connections – check monitor and joystick monitor.	
Joystick error (if equipped)	The PLC received bad data from the monitor joystick,	Check Akron controller software issue	
PLC configuration erro	PLC detects invalid configuration	Reprogram PLC configuration	
CANbus communications fault	Hardware gateway has lost communication with the PLC.	Check indicator light on PLC, check power to PLC, check connections.	