

MPE Multi-Unit Control Panel Shown



MPE-XC Single-Unit Control Panel
(Shown with TWLC keypad/display
mounted in door)

TWLC System

The Tempered Water Logic Control (TWLC) is an advanced microprocessor chiller control specifically designed for marine circulated water systems. The TWLC system maximizes system performance, protects the chillers with advanced fault protection monitoring and shut-down routines, and has easy menu-driven operation supplying the user with important system information.

System redundancy and easy field repair were the priorities when the TWLC was developed. Each chiller in a TWLC system has a dedicated power/logic board, and the boards are networked together to form an integrated system (automatically controlling up to 6 chillers). This design means that a single board or network failure will not shut down the entire system. The P/L board has board-mounted LEDs to help with troubleshooting, replaceable EPROM for software upgrades, and plug-in terminal strips and RJ-12 jacks which allow for quick field installation.

Interaction with the system is through the TWLC keypad/display. A simple 4-button keypad is used to change operation mode and to navigate through the menus to view and change system parameters. A backlit LCD display supplies easy to read information about the system, including water temperatures, operation mode, which chillers are running, and other detailed information. Three small LEDs on the keypad clearly indicate Cool or Heat modes, and faults. An alarm buzzer on the keypad can also signal a fault. Additional TWLC keypads can be installed to allow remote system access.

Set up and operation of the TWLC is fully automatic. It senses how many units are connected and programs the temperature staging and unit rotation of the units to pre-programmed parameters. The TWLC board has non-volatile memory so settings and recorded information are not lost even if power is interrupted. The large memory capacity allows the TWLC to record run time of the compressors and pumps, and store the fault history of each unit.

Another feature of the TWLC is that it can be connected to an on-board computer or modem to allow full remote access of the system. Custom software emulates the TWLC on the computer screen and navigation through the menus is identical to the TWLC keypad/display. If a land phone line is available, a modem can be connected and the system can be viewed and operated remotely, allowing a knowledgeable service agent to troubleshoot the system anywhere in the world.

Features

- Up to 6 tempering units can be integrated into one network
- Keypad/Display has a 4-button control and a 4-line backlit LCD display
- Multiple keypad/displays can be used for remote access
- Multi-unit panels come with circuit breakers for compressor and pump control
- Chiller staging based on circulated water temperature
- Compressor rotation to equalize run time of each unit
- Compressor and pump time delay to prevent simultaneous starting
- Records and logs faults and run times

Advanced Options

- Connect to an on-board computer or modem
- Current transducers to monitor compressor and pump amperage
- Seawater temperature sensors
- Refrigerant pressure transducers
- Loop water and seawater pressure transducers
- Control an optional source of heat (electric immersion heater or fuel-fired boiler)
- Remote unit shutdown for loadshedding
- Fault signal output for remote alarm

SINGLE-UNIT and MULTI-UNIT CONTROL PANELS

The TWLC system is available in 2 different control panel options, single-unit panels and multi-unit panels. Single-unit panels are less expensive than multi-unit panels and can often be fit in spaces where a large multi-unit panel won't fit. They are also typically in stock for quick delivery. Single-unit panels are often the answer for refit jobs where the vessel's power panel already has breakers for each chiller and pump.

Multi-unit panels are custom built for each system with circuit breakers and contactors for up to 6 chillers and the circulation and seawater pumps. Installation is easier than with single-unit panels because separate pump relays are not needed, all the network and high-voltage wiring is provided, and only one power input from the vessel is required. With all the P/L boards, breakers, relays, etc. in one location, a multi-unit panel is more convenient to the user.

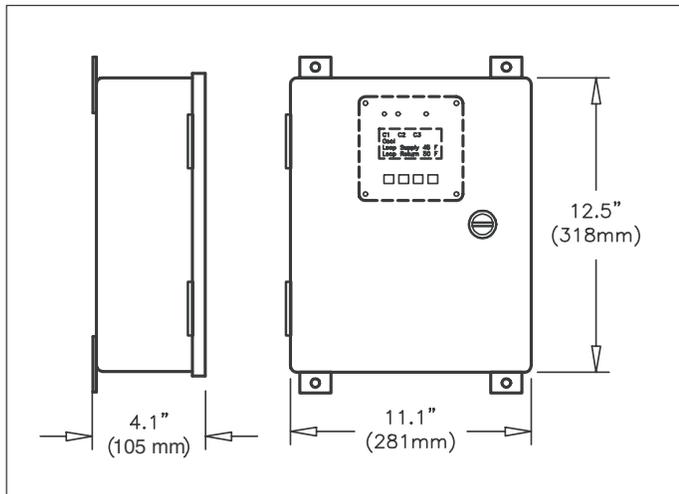
Single-Unit Panels

The MPE-XC will work with either 230V 1-phase compressors, or 230V – 460V 3-phase compressors. The control circuit is 230V 1ph, and a separate power feed is required on 380-460V systems. The MPE-VXC has the same features, but is for use with a variable frequency drive (VFD).

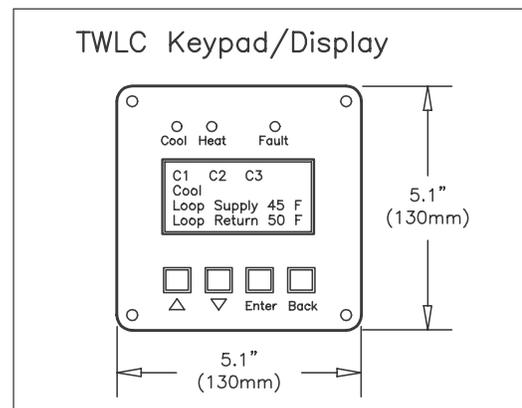
The MPE single-unit panel includes the P/L board, compressor contactor (or relay), 10 ft (3m) wire harness, control circuit fuses, and a short CNP cable to connect to a TWLC keypad/display.

In addition to the MPE single-unit panels (one per chiller), the system will require: one TWLC keypad/display, CNP network cables (one per panel), pump relays (for circulation and seawater pumps), and one temperature sensor to monitor the common loop water supply. The TWLC keypad can be installed in the door of the panel, or installed remotely (with a CNP cable). Multiple TWLC keypads (up to one per board) can be installed if desired.

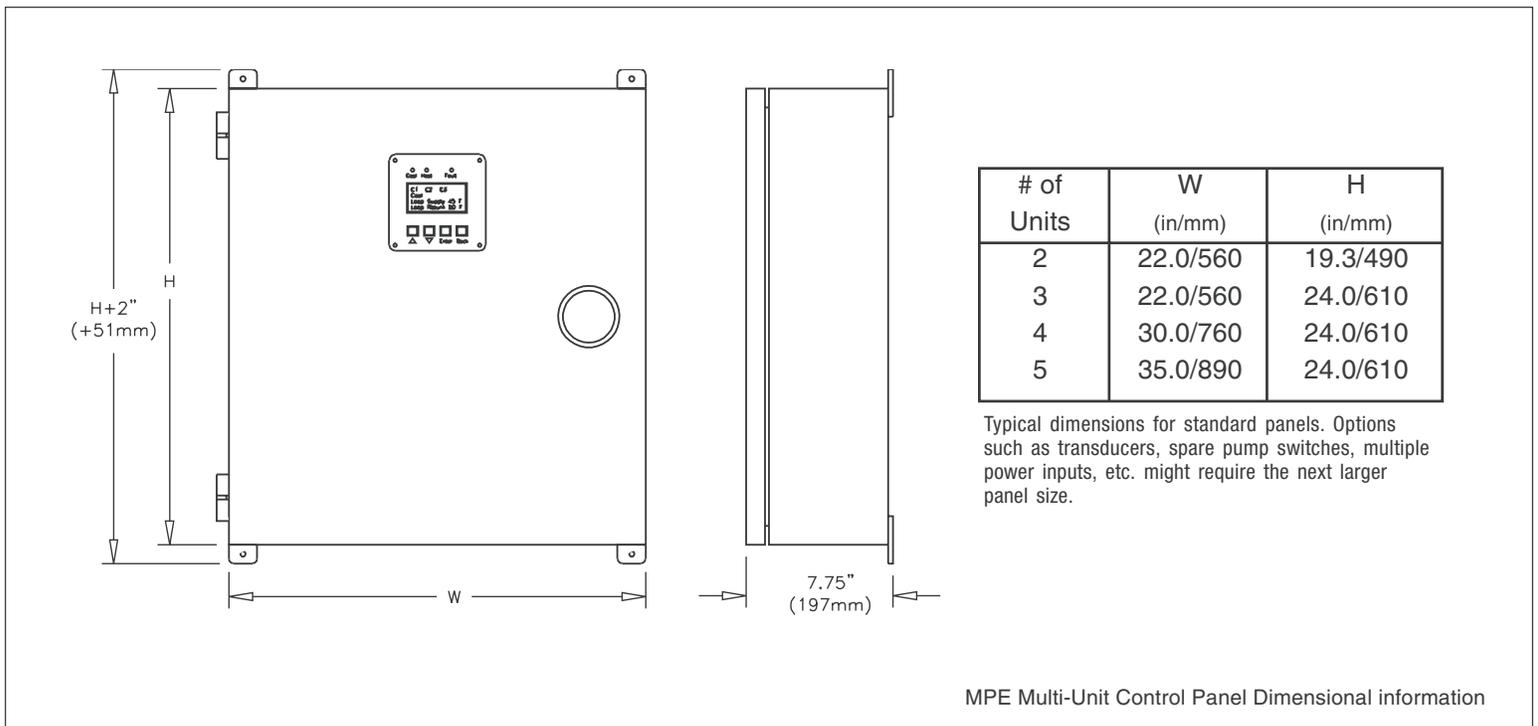
All of the optional inputs can be added to MPE single unit panels, and there is a location for a compressor current transducer in the panel. Temperature sensor wells are also available for the common loop water supply sensor, and for the seawater out sensors.



MPE-XC and MPE-VXC Single-Unit Panel Dimensions



Tempered Water Logic Control Dimensions



MPE Multi-Unit Panels

Custom multi-unit panels provide breakers and relays for the compressors and pumps all on one chassis. This allows the installer to bring in one power feed for the complete system, and there are no separate pump relays to install, and many options can be built into the panel.

Each multi-unit panel includes a TWLC keypad mounted in the door, fusing for the control circuit, a transformer on 380-460V panels for the control power, and a wire harness to connect to the chillers.

Since each multi-panel is custom built, there are many options available:

- **Spare Pump Switch** – Selector switches can be added for backup (spare) pumps.
- **Multiple Power Inputs** – Up to 3 power blocks can be installed to help divide the chiller and pump loads.
- **Auxiliary Water Heater** – If an auxiliary water heater is desired, the panel can be built with the appropriate breakers and contactors to control the heater.
- **Fault Output Relay** – A set of “dry” contacts can be installed to operate an alarm on the vessel’s monitoring system.
- **Longer Wire Harness** – The standard harness is 10 ft (3m) but longer harnesses are available, up to 30 ft (9m).
- **Frame Mounted Panel** – If a framed chiller is ordered, the panel can be mounted on the frame.
- **Load Shedding** – Terminals can be provided in the panel to allow a load-shedding system to remotely shut down individual chillers.

In addition to the options above, two different upgrade packages are available for multi-unit panels.

The Level 1 upgrade package adds current transducers for the compressors and pumps, seawater out temperature sensors in each chiller, a common seawater inlet temperature sensor, and the computer and modem adapters.

The Level 2 package includes all items in Level 1, plus: high and low refrigerant pressure transducers for each chiller, a seawater pressure transducer (to install on the discharge of the seawater pump) and a loop water pressure transducer (to install on the inlet of the loop water pump).

FAULTS

The system monitors all the inputs and will display 12 different faults based on the information received. Each fault has a specific routine that protects the unit while helping to prevent nuisance faults. Some will generate a sustained shutdown, which must be reset from the TWLC keypad.

If a fault is sensed, the fault LED on the TWLC keypad will light (and the buzzer will sound, if activated) and the specific fault will be displayed on the LCD screen. The fault signal output on the P/L boards will also be powered.

The faults monitored by the system are:

- **High Refrigerant Pressure**
- **Low Refrigerant Pressure**
- **Loop Water Flow Switch**
- **Loop Water Temperature Differential**
- **Loop Water High Temperature Limit**
- **Seawater Out Low Limit**
- **Seawater Temperature Differential**
- **Auxiliary Heater High Limit**
- **Temperature Sensor Fault**
- **Low Control Voltage**
- **Network Fault**
- **EPROM Error**

INPUTS

Each P/L board has up to 14 inputs. The six standard inputs are listed in bold. The other inputs shown (#7-14) are optional, and are available in upgrade packages or can be added separately.

1. **Loop Water Return Temperature Sensor**
2. **Loop Water Out Temperature Sensor**
3. **Common Loop Water Supply Temperature Sensor**
4. **Flow Switch**
5. **High Pressure Switch** (or Pressure Transducer)
6. **Low Pressure Switch** (or Pressure Transducer)
7. Compressor Current Transducer
8. Loop Water Pump Current Transducer
9. Seawater Pump Current Transducer
10. Seawater Out Temperature Sensor
11. Common Seawater Inlet Temperature Sensor
12. Loop Water Pressure Transducer
13. Seawater Pressure Transducer
14. Auxiliary Heater Temperature Sensor

OUTPUTS

There are 6 outputs on each board. Each line voltage (115 or 230VAC) output is through a board-mounted triac which can control a relay or contactor.

1. **Compressor**
2. **Reversing Valve**
3. **Loop Water Pump**
4. **Seawater Pump**
5. **Aux. Heater**
6. **System Fault**

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