Programming Guide

Standard Benshaw MX2 Off-the-Shelf Software for use with Pueblo Chillers

(Not applicable for Trane ONLY software MX/ MX2 starters)

⚠ SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

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Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.

NOTICE Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants-including industry replacements for CFCs and HCFCs such as saturated or unsaturated HFCs and HCFCs.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified according to local rules. For the USA, the Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.

⚠WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labeling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

⚠WARNING

Follow EHS Policies!

Failure to follow instructions below could result in death or serious injury.

- **All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Trane personnel should always follow local regulations.**

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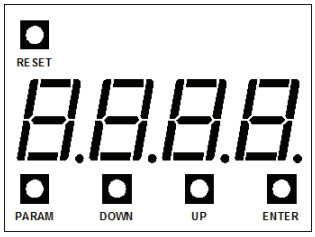
LED Display

Figure 1. LED display



LED Display

See Figure 1. The LED displays allows the following actions:

- View parameters, messages and faults.
- Show software revision on power up.

Programming

1. Press PARAM to enter the menu and then UP or DOWN to reach the desired parameter.
2. Press ENTER to show the present value of the parameter.
3. Press UP or DOWN to change the parameter value.
4. Press ENTER to store the new value or PARAM to abandon the change.

Figure 2. Messages

noL	No Line
rdy	Ready
Acc	Accelerating or Kicking
Acc2	Accelerating or Kicking with ramp 2
uES	Up to Speed
run	Run – Done with Accel ramp but not yet Up to Speed.
dcL	Decelerating Motor
A OL	Overload Alarm – The motor overload level is between 90% and 100%.
F OL	Overload Fault – The motor overload level has reached 100%.
L OL	Overload Lockout – A start is not allowed until the motor overload level cools below 60%.
L CP	Control Power Lockout – A start is not allowed because the control power is too low.
LOC	Lock out State
AbC	Phase order meter showing ABC
CbA	Phase order meter showing CBA
SPH	Phase order meter showing Single Phase
oxxx	xxx = overload content.
P xx	xx = Parameter code.
A xx	xx = Alarm code. If the condition persists, a fault will occur.
F xx	xx = Fault code.
oc	Instantaneous Overcurrent
dFLt	Default – Flashes when parameter defaults are loaded.
HEAt	Heater/Anti-windmill Mode
ES	Energy Saver
FLSH	In reflash mode
Prog	In reflash mode, programming
rEAd	In reflash mode, verifying
donE	In reflash mode, complete

Viewing Parameter Values

Parameter view mode can be entered by:

1. At the default meter display, press the PARAM key to enter parameter mode. "P 1" will be displayed to indicate Parameter 1.
2. Use the UP and DOWN keys to scroll through the available parameters.
3. Pressing the UP key from "P 1" will advance to parameter "P 2".
4. Pressing the DOWN key from "P 1" will wrap around to the highest parameter.
5. The value of the parameter can be viewed by pressing the ENTER key.
6. To view another parameter without changing/saving the parameter, press the PARAM key to return to the parameter number display.

Quick Meters

1. Press DOWN to display the motor thermal overload content.
2. Press UP to display the incoming line phase order.
3. Press ENTER to display the status meter.Fault Log
4. Select P8 and press ENTER. The most recent fault will be displayed as "xFyy" where x will be 1 to indicate the most recent fault is being displayed and yy is the fault code.
5. Press DOWN to view older faults. Up to 9 faults may be stored in the log.

Resetting a Fault

1. Press RESET to reset from a fault.

Resetting Parameters

1. Press and hold PARAM and ENTER on power up to reset parameters to default values.

Emergency Thermal Reset

1. Press RESET and DOWN to perform an emergency thermal reset.

Messages

To return to the default meter display either:

7. Press the PARAM key while in the parameter number display mode.
8. Wait 60 seconds and the display will return to the default meter display

Changing Parameter Values

Parameter change mode can be entered by:

1. At the default meter display, press the PARAM key to enter parameter mode.
2. Use the UP and DOWN keys to scroll through the available parameters.
3. The value of the parameter can be viewed by pressing the ENTER key.
4. When viewing the parameter value, the parameter can be changed by using the UP and DOWN keys.
5. To store the new value, press the ENTER key. When the ENTER key is pressed the value will be saved and the display will go back to parameter # "P_"

To exit parameter change mode without saving the new parameter value either:

6. Press the PARAM key to return to the parameter number display.
7. Wait 60 seconds and the display will return to the default meter display.

Power Up

The software version will be displayed as a series of blinking digits once power has been applied to the MX control. If the parameters were being reset on power up, "dFLt" will be flashed on the display for three seconds, then the software version will be displayed.

Stopped

When the starter is not in the run mode, the display will show the status condition of the starter, such as "rdY" (ready), "L OL" (Overload Lockout), "noL" (No Line).

Running

When running, the display will show the user selected meter function. The following meters can be selected using the "Meter" display parameter.

Table 1. Meters

Avg. RMS current	KW
Phase 1 RMS current	KVA
Phase 2 RMS current	KWh
Phase 3 RMS current	MWh
Current Imbalance%	Phase Rotation
GF Current (% FLA)	Line Frequency
Avg. Voltage (RMS)	Analog Input%
L1-L2 Voltage (RMS)	Analog Output%
L2-L3 Voltage (RMS)	Running Time Days
L3-L1 Voltage (RMS)	Running Time Hours
Overload%	Starts
Power Factor	TruTorque%
	Power%

Alarm Condition

When an alarm condition exists, the display alternates between displaying the selected meter and the alarm code. The alarm code is displayed as "A XX", where XX is the alarm code.

- When a thermal overload alarm condition exists, "A OL" will be displayed.
- When a no line alarm condition exists, "noL" will be displayed.

When the starter is stopped, the selected meter is not included.

Lockout Condition

When a lockout condition exists, the display shows the lockout code. The lockout code is displayed as "L XX: where XX is the lockout code. Following are the defined lockout conditions and their codes:

- When a motor thermal overload lockout condition exists, "L OL" will be displayed.
- When a power stack thermal overload lockout condition exists, "L Ot" will be displayed.
- When a low control power lockout condition exists, "L CP" will be displayed.

When there are multiple lockout codes, each will be displayed for 2 seconds.

Faulted Condition

When a fault condition exists, the display shows the fault code. The exceptions to this are as follows:

- When the fault is thermal overload trip, "F OL" will be displayed.
- When the fault is I.O.C. (Instantaneous over current), will be displayed.

Parameter Settings for Trane Chillers

When a Benshaw MX2 solid state started is installed on a Trane Chiller, the parameters shown in Table 2 must be set. For a listing of the parameters that remain at default setting, see Table 3, p. 9.

Parameter Changes for Trane Chillers

Table 2. Parameters to be changed for Trane chiller

Parameter Remote Display	LED	Display	Description	Setting Range	Units	Default	Setting for Pueblo Unit
Quick Start Group							
QST01	P1	Motor FLA	Motor FLA	1 to 6400	RMS Amps	10	Motor FLA
QST06	P6	Init Cur 1	Initial Current	50 to 600	% FLA	100	100
QST07	P7	Max Cur 1	Maximum Current 1	100 to 800	%FLA	600	260
QST08	P8	Ramp Time	Ramp Time 1	0 to 300	Seconds	15	1
QST09	P9	UTS Timer	Up To Speed Time	1 to 900	Seconds	20	10
Control Function Group							
No changes to existing default control function parameters are required.							
Protection Group							
PFN01	P32	Over Curr Lvl	Over Current Trip Level	Off,50-800	%FLA	Off	800
PFN05	P36	Cur Imbl Lvl	Current Imbalance Trip Level	Off, 5 - 40	%	15	40
PFN06	P37	Gnd Flt Lvl	Residual Ground Fault Trip Level	Off, 5 - 100	%FLA	Off	40
PFN07	P38	Over Vlt Lvl	Over Voltage Trip Level	Off, 1 - 40	%	Off	15
PFN08	P39	Undr Vlt Lvl	Under Voltage Trip Level	Off, 1 - 40	%	Off	15
PFN09	P40	Vlt Trip Time	Over/Under Voltage Trip Delay Time	0.1 - 90	Seconds	0.1	30
PFN17	P47	OL Cool Time	Motor Overload Cooling Time	1.0 - 999.9	Minutes	30	5
I/O Group							
I/O 01	P48	D1 1 Config	Digital Input # 1 Configuration	Off Stop Slow Speed Frwrd Slow Speed Revr Fault High Brake Disable Fault Low Brake Enable Fault Reset Disconnect Inline Cnfrm Bypass Cnfrm E OL Reset Local/Remote Heat Disable Heat Enable Ramp Select		Stop	Stop
I/O 02	P49	D1 2 Config	Digital Input # 2 Configuration			Off	Stop
I/O 03	P50	D1 3 Config	Digital Input # 3 Configuration			Off	Stop
I/O 05	P52	R1 Config	Relay Output # 1 Configuration	Off Shunt NFS Fault FS Ground Fault Fault NFS Energy Saver Running Heating UTS Slow Spd Alarm Slow Spd Fwd Ready Slow Spd Rev Locked Out Braking Overcurrent Ol Alarm Cool Fan Ctl Shunt FS		Fault FS	FLnF
I/O 06	P53	R2 Config	Relay Output # 2 Configuration			Off	Run
I/O 07	P54	R3 Config	Relay Output # 3 Configuration			Off	UTS

Table 2. Parameters to be changed for Trane chiller (continued)

Parameter							
Remote Display	**LED**	**Display**	**Description**	**Setting Range**	**Units**	**Default**	**Setting for Pueblo Unit**
			Function Group				
FUN 07	P74	Starter Type	Starter Type	Normal Inside Delta Wye-Delta Phase Ctl Curr Follow ATL		Normal	Inside delta
FUN 05	P76	Rated Voltage	Rated RMS Voltage	100, 110, 120, 200, 208, 220, 230, 240, 350, 400, 415, 440, 460, 480, 500, 525, 575, 600, 660, 690, 800, 1000, 1140	RMS Voltage	480	Rated Voltage
FUN 04	P77	Phase Order	Input Phase Sensitivity	Insensitive ABC CBA Single Phase		Insensitive	ABC
FUN 03	P78	CT Ratio	CT Ratio	72:1 96:1 144:1 288:1 864:1 2640:1 3900:1 5760:1 8000:1 14400:1 28800:1		288:1	2640 (or as Supplied)
	P82		Fault Log	1FXX - 9FXX			Fault Log

Parameters Remaining at Default Settings

Table 3. Parameters remaining at default setting from Benshaw

Parameter Remote Display	LED	Display	Description	Setting Range	Units	Default
			Quick Start Group			
QST00		Jump Code	Jump to a Parameter	1 to 9		1
QST02	P2	Motor SF	Motor Service Factor	1.00 to 1.99		1.15
QST03	P3	Running OL	Motor Overload Class Running	Off- 1 to 40		10
QST04	P4	Local Src	Local Source	Keypad Terminal Serial		Terminal
QST05	P5	Remote Src	Remote Source	Keypad Terminal Serial		Terminal
			Control Function Group			
CFN00		Jump Code	Jump to a Parameter	1 to 25		1
CFN01	P10	Start Mode	Start Mode	Voltage Ramp Current Ramp TT Ramp Power Ramp		Current Ramp
CFN02		Ramp Time 1	Ramp Time 1	0 to 300	Seconds	15
CFN03		Init Current 1	Initial Motor Current 1	50 to 600	% FLA	100
CFN04		Max Current 1	Max Motor Current 1	100 to 800	% FLA	600
CFN05	P24	Ramp Time 2	Ramp Time 2	0 to 300	Seconds	15
CFN06	P22	Init Current 2	Initial Motor Current 2	50 to 600	% FLA	100
CFN07	P23	Max Current 2	Max Motor Current 2	100 to 800	% FLA	600
CFN08	P11	Init V-T-P	Initial Voltage/Torque/Power	1 to 100	%	25
CFN09	P12	Max T-P	Maximum Torque / Power	10 to 325	%	105
CFN10	P13	Kick Lvl 1	Kick Level 1	Off, 100 to 800	% FLA	Off
CFN11	P14	Kick Time 1	Kick Time 1	0.1 to 10	Seconds	1
CFN12	P25	Kick Level 2	Kick Level 2	Off, 100 to 800	% FLA	Off
CFN13	P26	Kick Time 2	Kick Time 2	0.1 to 10	Seconds	1
CFN14	P15	Stop Mode	Stop Mode	Coast Volt Decel TT Decel DC Brake		Coast
CFN15	P16	Decel Begin	Decel Begin Level	100 to 1	%	40
CFN16	P17	Decel End	Decel End Level	99 to 1	%	20
CFN17	P18	Decel Time	Decel Time	1 to 180	Seconds	15
CFN18	P19	Brake Level	DC Brake Level	10 to 100	%	25
CFN19	P20	Brake Time	DC Brake Time	1 to 180	Seconds	5
CFN20	P21	Brake Delay	DC Brake Delay	0.1 to 3.0	Seconds	0.2
CFN21	P27	SSpd Speed	Slow Speed	Off, 7.1 , 14.3	%	Off
CFN22	P28	SSpd Curr	Slow Speed Current Level	10 to 400	% FLA	100
CFN23	P29	SSpd Timer	Slow Speed Time/Limit	Off, 1 to 900	Seconds	10
CFN24	P30	SSpd Kick Cur	Slow Speed Kick Current	Off, 100 to 800	% FLA	Off
CFN25	P31	SSpd Kick T	Slow Speed Kick Time	0.1 to 10	Seconds	1
			Protection Group			
PFN00		Jump Code	Jump To Parameter	1 to 17		1
PFN02	P33	Over Cur Tim	Over Current Trip Delay Time	Off, 0.1 - 90	Seconds	0.1
PFN03	P34	Under Cur Lvl	Under Current Trip level	Off, 5 - 100	%FLA	Off
PFN04	P35	Undr Cur Tim	Under Current Trip Delay Time	Off, 0.1 - 90	Seconds	0.1
PFN10	P41	Auto Reset	Auto Fault Reset Time	Off, 1 - 900	Seconds	Off
PFN11	P42	Auto Rst Lim	Auto Fault Reset Limit	Off, 1 - 10		Off
PFN12	P43	Ctrl Flt En	Control Fault Stop Enable	Off , On		On
PFN13	P44	Indep S/R OL	Independent Starting/Running Overload	Off, On		Off
PFN14	P45	Starting OL	Motor Overload Class - Starting	Off, 1 - 40		10
PFN15		Running OL	Motor Overload Class - Running	Off, 1 - 40		10

Table 3. Parameters remaining at default setting from Benshaw (continued)

Parameter Remote Display	LED	Display	Description	Setting Range	Units	Default
PFN16	P46	OL H/C Ratio	Motor Overload Hot/Cold Ratio	0 - 99	%	60
			I/O Group			
I/O 00		Jump Code	Jump To Parameter	1 to 19		1
I/O 04	P51	Dig Trp Time	Digital Fault Input Trip Time	0.1 - 90	Seconds	0.1
I/O 08	P55	Ain Trp Type	Anolog Input Trip Type	Off Low Level High Level		Off
I/O 09	P56	Ain Trp Lvl	Analog Input Trip Level	0 to 100	%	50
I/O 10	P57	Ain Trp Tim	Analog Input Trip Delay Time	0.1 to 90	Seconds	0.1
I/O 11	P58	Ain Span	Analog Input Span	1 to 100	%	100
I/O 12	P59	Ain Offset	Analog Input Offset	0 to 99	%	0
I/O 13	P60	Aout Fctn	Analog Output Function	Off 0 - 200% Curr 0 - 800% Current 0 - 150% Volt 0 -150% OL 0 - 10 kW 0 - 100kW 0 - 1 MW 0 - 10MW 0 - 100% Ain 0 - 100% Firing Calibration		Off
I/O 14	P61	Aout Span	Analog Output Span	1 to 125	%	100
I/O 15	P62	Aout Offset	Analog Output Offset	0 to 99	%	0
I/O 16	P63	Inline Config	Inline Configuration	Off, 1.0 to 10.0	Seconds	3
I/O 17	P64	Bypas Fbk Tim	Bypass 2M Confirm	0.1 to 5.0	Seconds	2
I/O 18	P65	Kpd Stop	Keypad Stop Disable	Enabled, Disabled		Enabled
I/O 19	P66	Auto Start	Power On Start Selection	Disabled Power Fault Power and Fault		Disabled
			Function Group			
FUN 00		Jump Code	Jump To Parameter	1 to 16		1
FUN 01	P79	Meter 1	Meter 1	Ave Current L1 Current L2 Current L3 Current Current Imbal Ground Fault Ave Volts L1-L2 volts L2-L3 volts L3-L1 Volts Overload Power Factor Watts VA Vars kW hours MW hours Phase Order Line Freq Analog Input Analog Output Run Days Run Hours Starts TruTorque% Power% Pk Accel Cur Last Start T		Ave Current

Table 3. Parameters remaining at default setting from Benshaw (continued)

Parameter Remote Display	LED	Display	Description	Setting Range	Units	Default
FUN 02		Meter 2	Meter 2	Ave Current L1 Current L2 Current L3 Current Current Imbal Ground Fault Ave Volts L1-L2 volts L2-L3 volts L3-L1 Volts Overload Power Factor Watts VA Vars kW hours MW hours Phase Order Line Freq Analog Input Analog Output Run Days Run Hours Starts TruTorque% Power% Pk Accel Cur Last Start T		Ave Volts
FUN 06	P75	Motor PF	Motor Rated Power Factor	-0.01 (Lag) to 1.00(Unity)		-0.92
FUN 08	P73	Heater Lvl	Heater Level	Off, 1 - 40	%FLA	Off
FUN 09	P72	Energy Saver	Energy Saver	Off, On		Off
FUN 10	P70	Comm Drop #	Communications Address	1 to 247		1
FUN 11	P69	Com Baud Rate	Communications Baud Rate	1200, 2400, 4800, 9600, 19200	bps	19200
FUN 12	P68	Com Timeout	Communications Timeout	Off, 1 to 120	Seconds	Off
FUN 13	P71	Com Parity	Communications Byte Framing	Even, 1 Stop Bit Odd, 1 Stop Bit None, 1 Stop Bit None, 2 Stop Bit		Even, 1 Stop Bit
FUN 14	P80	Software 1	Software Part # 1	Display Only		
FUN 16	P67	Misc Command	Miscellaneous Commands	None Reset RT Reset kWh Reflash Mode Store Parameters Load Parameters Factory Reset Std BIST Powered BIST		None
FUN 20	P81	Passcode	Passcode			Off

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