E5-MX

Switch and Distribution Amplifier

USER'S HANDBOOK

Quartzlock

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Revision history

Revision	Date	Description	By
1	July 2023	Initial Release	O. Khorremy
1.01	August 2023	Added new commands and software console	Alex. K

Contents

Safety Considerations

General

This product and related documentation must be reviewed for familiarization before operation. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the instrument may be impaired.

Before Applying Power

Verify that the product is set to match the available line voltage and the correct fuse is installed.

Before Cleaning

Disconnect the product from operating power before cleaning.

WARNING

Bodily injury or death may result from failure to heed a warning. Do not proceed beyond a warning until the indicated conditions are fully understood and met.

CAUTION

Damage to equipment, or incorrect measurement data, may result from failure to heed a caution. Do not proceed beyond a caution until the indicated conditions are fully understood and met.

This equipment must be earthed

An uninterruptible safety earth ground must be maintained from the mains power source to the product's ground circuitry.

WARNING

When measuring power line signals, be extremely careful and use a step down isolation transformer whose output is compatible with the input measurement capabilities of this product. The product's front and rear panels are typically at earth ground. Thus, never try to measure AC power line signals without an isolation transformer.

WARNING

Instructions for adjustments when covers are removed and for servicing are for use by service- trained personnel only. To avoid dangerous electrical shock, do not perform such adjustments or servicing unless qualified to do so.

WARNING

Any interruption of the protective grounding conductor (inside or outside the instrument) or disconnecting of the protective earth terminal will cause a potential shock hazard that could result in personal injury. Grounding one conductor of a two conductor out-let is not sufficient protection.

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

If the instrument is to be energised via an autotransformer (for voltage reduction) makes sure the common terminal is connected to the earthed pole terminal (neutral) of the power source.

Instructions for adjustments while the covers are removed and for servicing are for use by service- trained personnel only. To avoid dangerous electrical shock, do not perform such adjustments or servicing unless qualified to do so.

For continued protections against fire, replace the line fuse(s) with fuses of the same current rating and type (for example, normal blow time delay). Do not use repaired fuses of short-circuited fuse holders.

Voltage, Frequency and Power Characteristics

AC Plug

Voltage 100-240V AC

AC Frequency 50-60Hz

Power characteristics

1000mA Max Voltage

Environmental Conditions

Temperature

Operating (ambient)	-20°C to +65°C
Storage	-40°C to +85°C

Magnetic Field

Sensitivity	≤$2x10^{-11}$/ Gauss
Atmospheric Pressure	-60m to 4000m
	<$1x10^{-13}$/ mbar

Replaceable Fuse Characteristics

Rackmount units: - 1000mA time-lag HBC

Cleaning Instructions

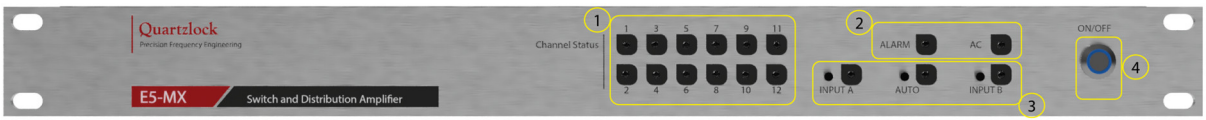
To ensure long and trouble operation, keep the unit free from dust and use care with liquids around the unit.

Be careful not to spill liquids onto the unit. If the unit does get wet, turn the power off immediately and let the unit dry completely before turning it on again.

Clean with a damp (with water) cloth.

Never spray cleaner directly onto the unit or let liquid run into any part of it. Never use harsh or caustic products to clean the unit.

Front panel LED indicators



1. Output channels LED indicators

ON - Green : Signal is present on the output channels
ON - Red : Fault indicator, No signal is present on the output channels

2. AC and Alarm LEDs

AC - Green : the unit is powered
AC - OFF : the unit is not powered
ALARM – Red flashing: fault identified

3. Front Panel Pushbuttons and LED

Pushbutton Action	Result
INPUT A	Selects INPUT A
INPU B	Selects INPUT B
AUTO	Autoswitch mode
Press and hold Auto for 10 seconds	Resets and clears faults

4. Power switch

Power switch : The blue LED ring will lite when the unit is powered. The unit is OFF when the blue LED ring is OFF.

LED Function

LED	Green solid	Green slow flash	Red Solid	Red Slow flash	Red fast flash	Amber solid	Amber Slow flash	OFF
AC	Unit powered	N/A	N/A	N/A		N/A	N/A	NO power
ALARM	N/A	N/A	N/A	N/A	Fault detected	N/A	N/A	N/A
INPUT A	Signal detected, Input B selected	Signal detected, Input A selected	Signal not detected	Input A signal not detected, but it is selected	N/A	Input A is not selected. A fault was detected and resolved. Press input A or AUTO to change to green	Input A is selected. A fault was detected and resolved. Press input A or AUTO to change to green	N/A
INPUT B	Signal detected, Input A selected	Signal detected, Input B selected	Signal not detected	Input B signal not detected, but it is selected	N/A	Input B is not selected. A fault was detected and resolved. Press input B or AUTO to change to green	Input B is selected. B fault was detected and resolved. Press input B or AUTO to change to green	N/A
AUTO		Auto mode, Input A, or input B selected	Fault detected	N/A	N/A	AUTO is active. Fault was detected on input A/B, and an active input is selected	N/A	No input or manual mode selected
1-12 CH	Signal detected		No signal detected		N/A	N/A	N/A	N/A

Rear panel connectors

1. **Power = AC power input**

   IEC filter 320, fused at 1Amp

2. **COMPORT settings**

   The 9 pin D-sub is configured to output fault and for command line interface.

Pin No	Function	Description
1	Fault output	Logic High = fault, Logic Low = No fault
2	TX (RS232)	Serial transmit
3	RX (RS232)	Serial receive
5	Ground	

The E5-MX device can be configured via serial port located on the rear panel.

Serial Port Parameters

The following parameters are the serial port configuration

Serial port parameters	
Baud rate	115200
Data	8
Parity	None
Stop bit	1
Flow control	None

3. **RF output channels**

Digital and RF signal output on 12 BNC connectors

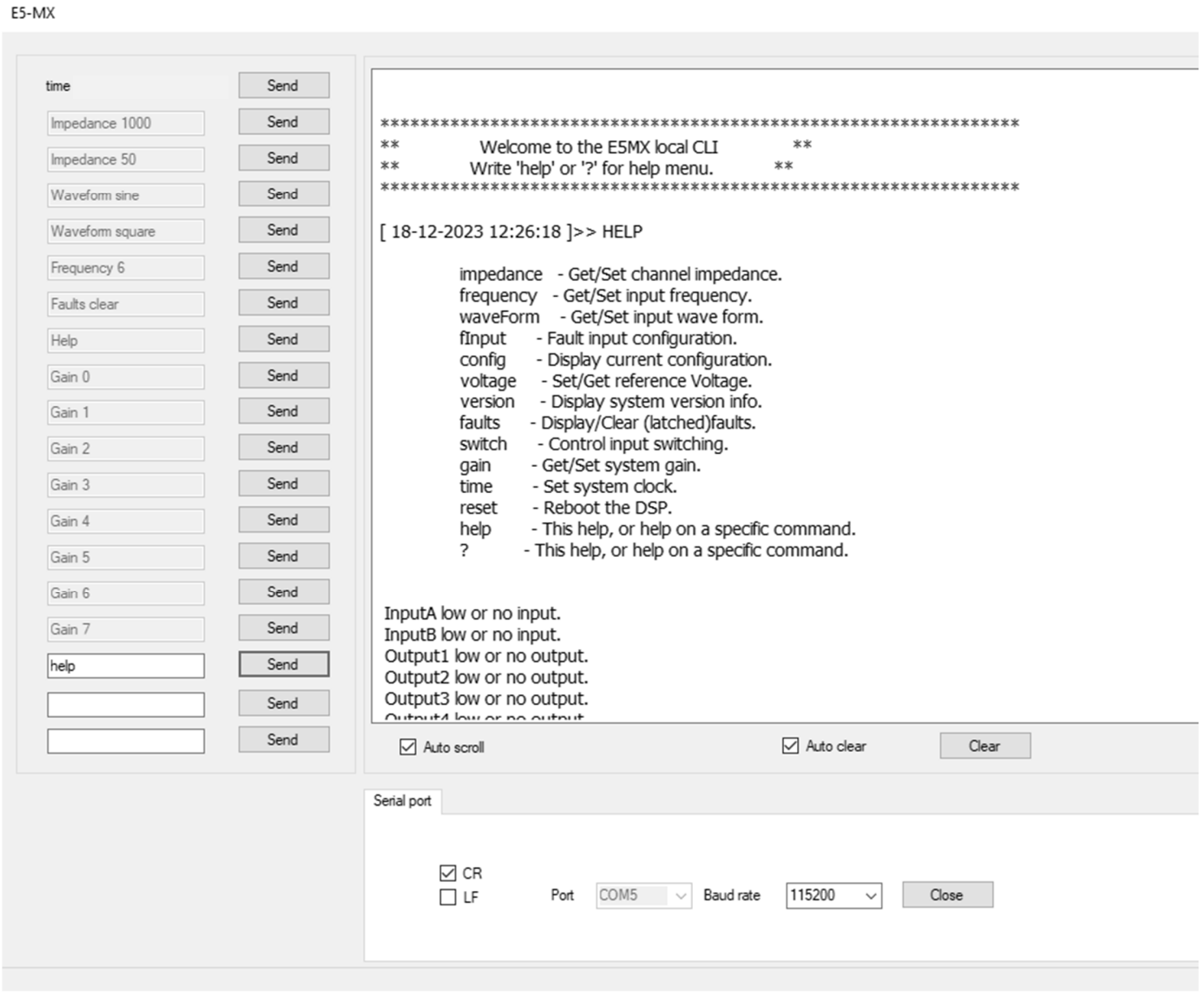
4. **RF and Alarm inputs**

Input ‘A’ and ‘B’ for RF and digital signals

‘Alarm A’ and ‘Alarm B’ for and external alarm input

E5-MX console software

The console software can be used to send and receive commands to configure the E5-MX. There fixed command preselected for ease of use. Three additional command fields available to enter commands by user.



Quick setup – How to configure

Use the following procedure containing the individual parameters and commands to configure the unit via serial port interface. Connect the E5-MX to a computer via RS232 port and launch the **E5-MX** console software.

1. **frequency** [<1-15>] (set the value of frequency range).

2. **Waveform** [<Sine/square>] (set the wave input waveform sine/square).

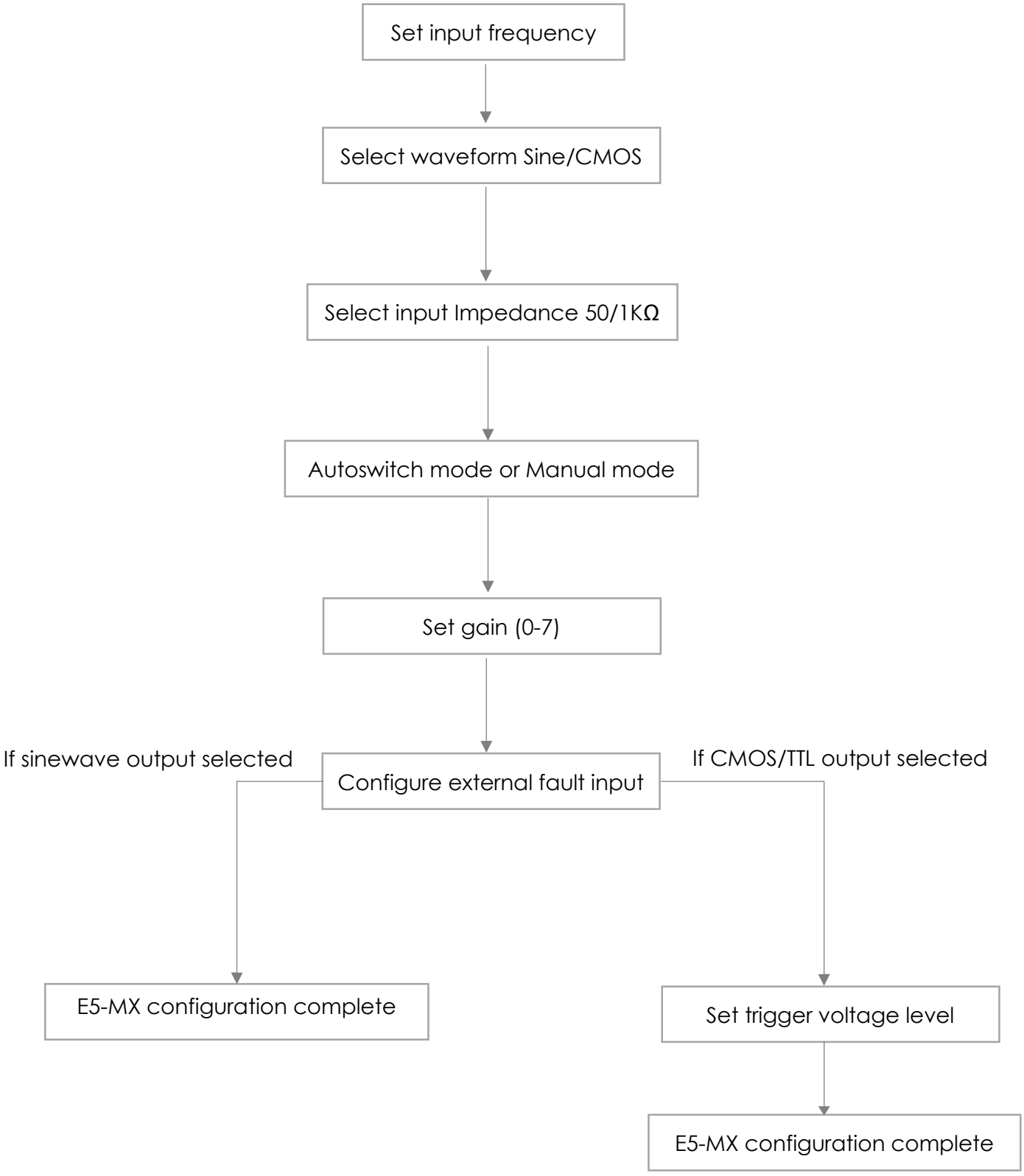
3. **Impedance** [<50 | 1000>] (set the value of impedance to either 50Ω or 1000Ω).

4. **Switch mode Auto or manual :** Select auto or manual mode for input A and B

5. **Fault input:** Enable/disable external fault input and the fault logic state (High or Low)

6. **voltage** [<0-5>] if input signal is CMOS/TTL, then set the reference threshold for inputs A and B

The flow chart is to provide visual guide in how to configure the E5-MX.



Command Line Interface

```
****************************************************************
**              Welcome to the E5MX local CLI              **
**            Write 'help' or '?' for help menu.           **
****************************************************************

[ 06-10-2023 14:11:12 ]>> HELP

 impedance   - Get/Set channel impedance.
 frequency   - Get/Set input frequency.
 waveForm    - Get/Set input wave form.
 fInput      - Fault input configuration.
 config      - Display current configuration.
 voltage     - Set/Get reference Voltage.
 version     - Display system version info.
 faults      - Display/Clear (latched)faults.
 switch      - Control input switching.
 gain        - Get/Set system gain.
 time        - Set system clock.
 reset       - Reboot the DSP.
 help        - This help, or help on a specific command.
 ?           - This help, or help on a specific command.
```

Set or get the input waveform

Input commands	Description
Waveform?	Returns the instructions how to input the command
waveform	Returns the current setting
Waveform sine	Signal wave form is Sine
Waveform square	Signal wave form is Square

Set or get the input Impedance

Input commands	Description
Impedance	Returns the current setting
Impedance 50	Sets impedance to 50 Ohms
Impedance 10000	Sets impedance to 1000 Ohms

How to get or set input/output frequency

Input commands	Description/Reply
Frequency?	Returns the instructions how to input the command
Frequency	Returns the current set frequency input
Frequency 1	Frequency 1Hz to 10Hz CMOS/TTL Input
Frequency 2	Frequency 10Hz to 100Hz CMOS/TTL Input
Frequency 3	Frequency 100Hz to 1KHz
Frequency 4	Frequency 1KHz to 10KHz
Frequency 5	Frequency 10KHz to 100KHz
Frequency 6	Frequency 100KHz and above
Frequency 7	Frequency AM IRIG 100Hz
Frequency 8	Frequency AM IRIG 1KHz
Frequency 9	Frequency AM IRIG 10KHz
Frequency 10	Frequency digital IRIG A
Frequency 11	Frequency digital IRIG B
Frequency 12	Frequency digital IRIG D
Frequency 13	Frequency digital IRIG E
Frequency 14	Frequency digital IRIG G
Frequency 15	Frequency digital IRIG H

Set or get fault configuration

Input commands	Description/Reply
fInput?	Returns the instruction for input command
fInput	Returns the current configuration
finput <A/B> <disable|[enable<low/high>]><CR> Examples: **finput A enable high** **finput B enable high** **finput A disable high** **finput B disable high** **finput A enable low** **finput B enable low** fault A input=enable, level = high means that a TTL level=high (or open circuit) on the input indicates a fault fault A input=enable, level=low means that a TTL level = low on the input indicates a fault	

Display the current configuration

Input commands	Description
Config?	Returns the instruction for input command
Config	Returns the saved parameters of unit configuration

Set or get the input comparator voltage

Input commands	Description
voltage?	Returns the instructions how to input the command
voltage	Returns the voltage level detected by the comparator
The voltage reference input range is 0V to +5V Example to set the voltage for 2.5 volts: Enter **voltage 2.5** <CR>	

Display or clear Faults

Input commands	Description
faults?	Returns the instructions how to input the command
faults	Returns the current fault detected by the unit

Set gain of output signal

The output gain can be adjusted between ±3dBm.

Input commands	Description
gain?	Returns the instructions how to input the command
gain	Returns the current fault detected by the unit
The gain adjustment range is between 0-7. Gain 3 is at centre unity gain level. Increase the gain number will decrease the gain and decreasing will increase the gain. Example to increase gain or decrease by 1dBm: To increase gain Enter **gain 2** <CR> To decrease Enter **gain 4** <CR>	

Mode of switching

The E5-MX offers manual and Auto mode.

Manual: In manual switching mode, selecting Input A or Input B will connect that input directly to the twelve outputs. Input A or Input B can be selected manually by pressing the corresponding front panel input button, or by sending the appropriate command on the serial port command line interface.
Auto: To use auto-switching mode successfully, it is first necessary to set up the conditions of comparison. The conditions of comparison are set up over the command line interface. The E5-MX allows for a voltage level, and a signal time duration comparison to be made with the selected input signal. Once the conditions of comparison are set up, the selected input can be activated. This can be done manually by pressing "Auto" button on the front panel, or by sending the appropriate command over the command line interface. The command is that either input signal A or signal B is to be selected.

Input commands	**Description**
switch?	Returns the instructions how to input the command
switch	Returns the current setting of mode of switch
Example to set auto mode: Enter **switch auto** <CR> Example to set manual mode, and set A as the selected input channel Enter **switch A** <CR>	

Set or get the system clock and date

Input commands	**Description**
time?	Returns the instructions how to input the command
time	Returns the system time and date
Example to set time and date: Time [<dd> <mm> <yyyy> <hh:mm:ss>] <CR> Enter 12 10 2023 15 08 05 <CR>	

How to reset the E5-MX processor

Input commands	Description
reset?	Returns the instructions how to input the command
reset	It reset the processor and reboot in 10 seconds
Note: The E5-MX configurations including system time and date after sending the rest command.	

Firmware version

Input commands	Description
version?	Returns the instructions how to input the command
version	Returns the current firmware version , device ID and calibration information

Specifications

Standards

CE

Emissions	EN 55022
Immunity	EN 55024
Safety	EN 60950-1

FCC

Part 15 Subpart B, Class A

Electrical RF Signals

Signal Inputs

RF

Frequency	100Hz - 10MHz
Level	0 to 1Vrms (Do not exceed 15dBM)
Impedance	50Ω or 1kΩ
Isolation A to B	>85dB

Pulse/DC IRIG time code

Frequency	1PPS to 10MPPS
Level	0-6VP-P
DutyCycle	0 to 100%
Impedance	50Ω or 1kΩ

AM IRIG timecode

Frequency	1PPS to 10MPPS
Level	0-6Vp-p
Modulation Frequency	Up to 1MHz
Code Format	Any IRIG Format, IEEE 1344, NASA 36, 2137, XR3
Impedance	50Ω or 1kΩ

Outputs

RF

Frequency	100Hz to 10MHz
Level	1V rms (15dBM max)
Gain	±3dBm – use command line via serial port
Harmonic Non-Harmonic Load Impedance	<-40dBc <-80dBc 50Ω
Isolation	>80dB

Additive Phase Noise

Phase noise measured at 10 MHz, +10 dBm input level.

1Hz	-128dBc/Hz
10Hz	-140dBc/Hz
100Hz	-145dBc/Hz
1kHz	-150dBc/Hz
10kHz	-157dBC/Hz

Pulse/DC IRIG

Frequency	1PPS - 10MPPS
Level	5V peak
Rise Time	<20ns
Fall Time	<20ns
Jitter	<200ps rms
Skew	<+/-2ns output to output
Load impedance	50Ω

AM IRIG Timecode

Frequency 1PPS to 10MPPS
Level 0-6Vp-p
Modulation Frequency Up to 1MHz
Code Format Any IRIG Format, IEEE 1344, NASA 36, 2137, XR3
Load Impedance 50Ω

Alarm Input

Normal State

2.2 to 5.0 V	(TTL High) Configured via CLI.
Can be High or Low	
<0.8 V	(TTL Low)

Alarm State Connectors BNC
Qty 2 (1 for A input & 1 for B input)
Enable/Disable Configured via serial port.
Default is disabled

Quartzlock

Precision Frequency Engineering

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