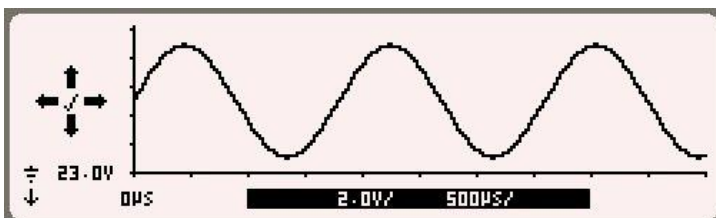# Application Note

Oscilloscope Function

This application note gives general information on the oscilloscope function in the MX-5000 panels.

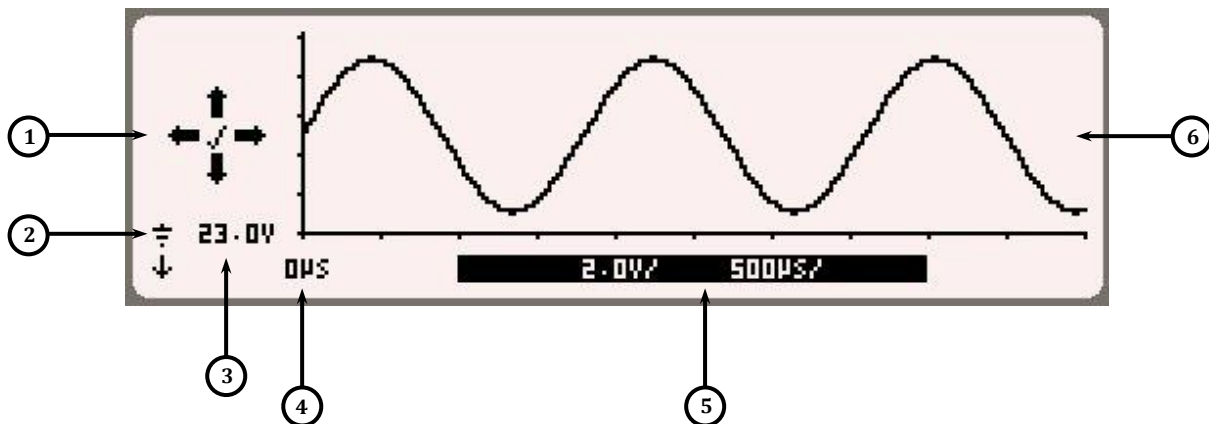This page is intentionally left blank.

INTRODUCTION

The oscilloscope function is one of the service diagnostics tools built into the Mx-5000 Series control panels.

It presents a graphical representation of the signalling voltages / currents and waveforms on the display to give a detailed view of the loop operational conditions that is not possible using multi-meters or voltmeters.

The basic operation of the oscilloscope, described in this document, is common to all of the detector protocols available in the panel. As the nature of the specific protocols is different, additional specific information is given in each of the protocol application notes.

The active area for the scope waveform data is 200 x 50 pixels. An example display screenshot depicting a sine wave is shown below.

Key:

1. Navigation keys – Use to move the waveform in the X & Y direction.
    The '✓' is used to enter and exit a 'scale-change' screen that allows changes to the vertical or horizontal scale.

2. Ground symbol – appears when the 'x' axis is not at the ground reference.

3. 'Y' axis origin level.

4. 'X' axis origin time.

5. Current 'Y' axis units per division and 'X' axis time per division.

6. Waveform data.

Scope Specifications

The scope function displays the information in an area 50 (Y-Axis) x 200 (X-Axis) pixels. The scope display can be adjusted to the vertical and horizontal ranges as shown in the tables below:

Vertical Scale (Y Axis) – Voltage

Voltage Volts / Div	Pixels/Div (Qty of Div)	Each Pixel Representing	Max Vertical Voltage Range	Sample Scale at Base Card
0.5	10 (5)	50mV	2.5V	50mV/bit (full range - up to 12.5V)
1	10 (5)	100mV	5.0V	50mV/bit (full range - up to 12.5V)
2	10 (5)	200mV	10.0V	50mV/bit (full range - up to 12.5V)
5	10 (5)	500mV	25.0V	200mV/bit (full range - up to 50V)
10	10 (5)	1V	50.0V	200mV/bit (full range - up to 50V)

Vertical Scale (Y Axis) – Current (Future Option)

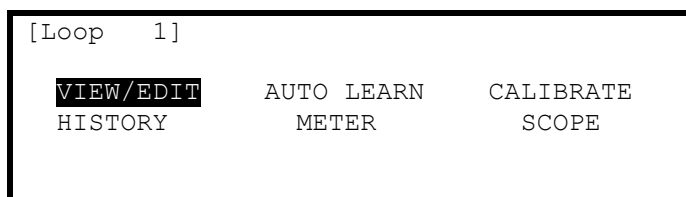| Current mA / Div	Pixels/Div (Qty of Div)	Each Pixel Representing	Max Vertical Current Range	Sample Scale at Base Card
10mA	10 (5)	1mA	50mA	1mA/bit (full range - up to 250mA)
20mA	10 (5)	2mA	100mA	1mA/bit (full range - up to 250mA)
50mA	10 (5)	5mA	250mA	1mA/bit (full range - up to 250mA)
100mA	10 (5)	10mA	500mA	10mA/bit (full range - up to 2.5A)
200mA	10 (5)	20mA	1A	10mA/bit (full range - up to 2.5A)
500mA	10 (5)	50mA	2.5A	10mA/bit (full range - up to 2.5A)

Horizontal Scale (X Axis) – Time

Time uS / Div	Divisions & (Pixels / Div)	Each Pixel Giving	Giving a Screen Range	Sample Time & Total Sampling Period (buff = 2000)
100	10 (20)	5us	1ms	5us (10ms)
200	10 (20)	10us	2ms	10us (20ms)
500	10 (20)	25us	5ms	25us (50ms)
1000 (1ms)	10 (20)	50us	10ms	50us (100ms)
2000 (2ms)	10 (20)	100us	20ms	100us (200ms)
5000 (5ms)	10 (20)	250us	50ms	250us (500ms)
10000 (10ms)	10 (20)	500us	100ms	500us (1s)

The normal quantity of scope data sent to the display is 2000 bytes. This allows a full screen of data to be displayed. The maximum quantity of data that can be sent is 2000 bytes and this allows the scrolling of data through '10 effective' screens when viewed at the default sampling rate.

The X-Axis time scale will default to the sampled rate of the data but can be changed manually. Changing the time scale from the default sampled rate can result in distortion of the displayed waveform and provide a misleading representation of the stored data. If required, the data should be sampled again at the required sampling rate.
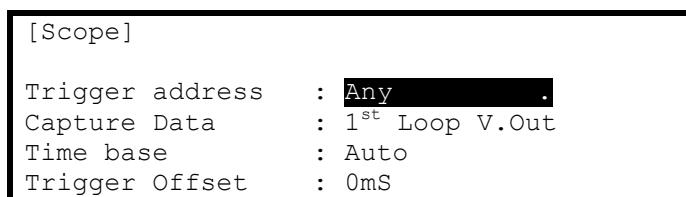
OPERATION

From the COMMISSION-LOOPS Menu, select the loop required.

```
[Loop   1]

  VIEW/EDIT     AUTO LEARN    CALIBRATE
  HISTORY        METER          SCOPE

```

Press the ↑↓←→ buttons to highlight the scope option and then press the ✔ button to select.

The display then provides a list of the possible items on which to select the type of waveform to view.

```
 [Scope]

Trigger address   : Any          .
Capture Data      : 1st Loop V.Out
Time base         : Auto
Trigger Offset    : 0mS
```

Use the ↑↓ buttons to highlight any of the four options.

To change an option use the ←→ buttons

Trigger Options

Trigger Address: Any, 1, 2, 3, … maximum device number

Capture Data: Loop Output Voltage, Loop Input Voltage

Time Base: Auto, 10mS, 20mS, 50mS, 100mS, 200mS, 500mS

Trigger Offset: 0mS, 1mS, 2mS, 3mS, … up to 50mS (depending on time base)

Trigger Address

Select to view the loop voltages when the panel is communicating to a specific loop device or select "Any" – the panel will then trigger the scope at the next device address.

Capture Data

Select either the output from the loop driver or the return signal to the loop driver.

Time Base

Select "Auto" or select the required duration.

Trigger Offset

The triggering will normally occur at the start of a communications to a device. The display can be configured to start the data capture after this point with an offset.
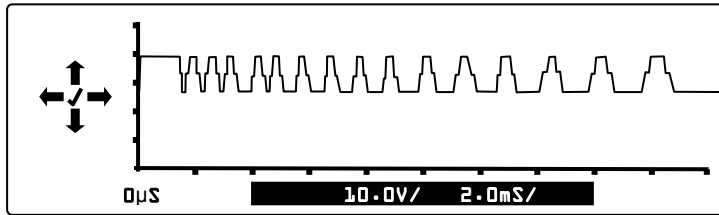
Capturing the Scope Trace

When the required settings have been selected, press the Press the ✔ button.

Whilst the panel is capturing the measurements for the selected settings, the display shows:

```
WORKING ...
```

When the measurements have been captured, the display will show the loop voltage in the form of a waveform.

The scaling factors are pre-defined by the panel to show the waveform in greater detail.

Scale Factor Adjustment

The scaling factors can be adjusted.

For example, to view the signalling pulses at maximum, first use the ↑↓ buttons to centralise / position the waveform portion required in the centre of the display. Then press the ✔ button to adjust the the scaling factor.
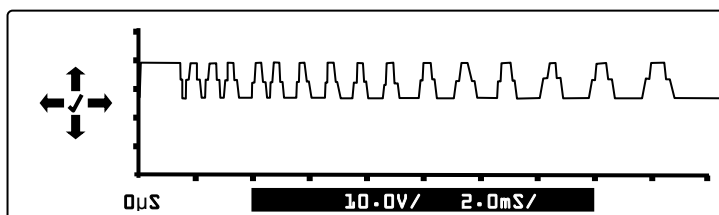

Press the ↑↓ buttons to adjust the amplitude scaling of the signal – the scaling factor figures are automatically updated.

Press the ←→ buttons to adjust the time base scaling of the signal – the scaling factor figures are automatically updated.
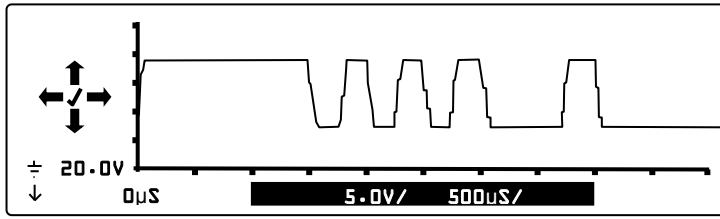
Then press the ✔ button to confirm the scaling factor adjustment. The display will revert to showing the waveform.

If part of the waveform is not or is not fully in the window, use the ↑↓ buttons to re-adjust Y-axis reference start voltage.

Examples:

Default Scope View: Scaling 10V/division, 2mS/division

Expanded Scope View: Scaling 5V/division, 500µS/division

Press the ← → buttons to scroll through the captured waveform. The x-axis marker will show the time offset from the beginning of the data capture point.

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