

Bently Nevada 60M100 Monitor

Bently Nevada* Asset Condition Monitoring



Description

The 60M100 Condition Monitoring System provides continuous on-line monitoring of Wind Turbine machine trains using sophisticated signal processing algorithms and machine operating states. The 60M100 Monitoring System, as a part of Condition Based Maintenance, lets wind turbine owners know, months in advance, that a turbine defect exists before failure of turbine assets occur. Bently Nevada's Condition Monitoring Solution can save turbine owners hundreds of thousands to millions of dollars per year in lost revenue, depending on the size of the wind farm. Turbine owners can expect to see cost savings from several sources including reduced crane costs, as well as early detection and damage minimization. Moreover, turbine owners will experience a reduction in unnecessary turbine outage and production loss.

The 60M100 Monitor is a capable and flexible system that can be used as an independent standalone condition monitoring system, a networked distributed collection of inter-operating systems, or as an integrated part of a machine OEM's control & instrumentation package. The 60M100 monitor includes features and advantages not provided in other systems. The monitor systems have all functionality required for condition monitoring of Wind Turbine machine trains including signal conditioning, alarming, configuration, speed inputs, and control system communication. The system components are:

- 60M100 monitor
- Adapt.wind software
- Transducers and cables

Sophisticated signal processing algorithms extract dozens of measurements and health indices from each accelerometer point and can be custom tuned to specific bearing and gear box characteristics.



60M100 Overview

The 60M100 Condition Monitoring System is specifically designed for continuous permanent monitoring of wind turbine generator machine trains. It is designed for monitoring applications that require extremely high reliability and availability. Applications that will be addressed by the 60M100 System include but are not limited to:

- Tower Sway
- Main Bearing
- Main Rotor
- Gear Boxes
 - All Internal Bearings
 - All Gear Meshes
 - Debris Monitoring
- Generator Bearings
- Generator Grounding

Special configuration or modifications to a standard monitor can be addressed through Bently Nevada's Custom Products Engineering. Contact your local Bently Nevada sales professional for further information.

60M100 Digital Communications

The 60M100 System includes digital communication capabilities for connection to ADAPT software using proprietary protocols via Ethernet connections. Moreover, the system provides extensive communication capabilities of all monitored values and statuses for integration with process control and other automation systems using Ethernet TCP/IP communications capabilities. It permits Ethernet communications with other 60M100 systems and System Software. Supported protocols include:

Modbus/TCP

Industry standard Modbus protocol over TCP. The 60M100 supports both server and client mode.

60M100 System Description

The 60M100 is a powerful and versatile Condition Monitoring system that provides basic monitoring functions and advanced signal processing and rules in a compact, robust unit. The module conditions the input signals to make various measurements and compares the conditioned signals with user-programmable alarms.

Capable of taking input from different sensor types, the 60M100 System can support up to 12 dynamic channel inputs, two Keyphasor signals, and digital communications. Channel 1 through channel 10 interface with 2-wire ICP type accelerometers. Channels 11 and 12 can be configured to interface with either 2-wire ICP type transducers or 3-wire proximity probes. Each dynamic channel can be independently configured with flexible signal processing options. The Keyphasor channels interface to either 3-wire proximity probes or other speed sensors which are powered externally.

The module provides enhanced capability for monitoring rolling element bearing machinery and gearing through its 24 bit Analog/Digital conversion and 40 kHz bandwidth design.

The 60M100 System is not a substitute for hard wired safety systems, nor does it replace the standard systems for the acquisition of operational data of the wind turbine.



Specifications

60M100 System Electrical Specifications

Input Power

Min: 18 Vdc
Max: 36 Vdc

Current

Max: 1.7 A

Inrush Current

Max: 2.7 A, less than 5 ms

60M100 Processor Module Specifications

Inputs

Max: 12 dynamic signals and 2
Keyphasor signals

Dynamic Range

110 dB @ fs = 102.4 ksps

Signal/Noise Ratio

110 dB @ fs = 102.4 ksps

A/D Conversion

Sigma-Delta 24 bits nominal

Bandwidth

0 to 40 kHz

Outputs

Two Independent Ethernet ports

Net A: 10/100 BaseT
Network DHCP Port

Net B: 10/100 BaseT
Local Static IP Port

Buffered Signal Outputs

Two 15 pin DSUB connector
550 ohm output impedance

LEDs

POWER LED

Indicates when a proper power
input is present.

OK LED

Indicates when the system is
functioning properly.

Danger LED

Indicates an Danger Alarm
condition

Alert LED

Indicates an Alert condition

Kph 1 OK LED

Indicates that Keyphasor signal 1
is triggering.

Kph 2 OK LED

Indicates that Keyphasor signal 2
is triggering.

NetA

Indicates that Network A has a
valid link

TX/RX A

Indicates that network traffic is
flowing on Network A

Net B

Indicates that Network B has a
valid link

TX/RX B

Indicates that network traffic is
flowing on Network B



Accuracy

Direct pk or rms

Within $\pm 0.5\%$ of full-scale typical,
 $\pm 1.1\%$ Worst Case

Bias

+0.4 V / -0.8 V typical,
+0.8 V / -1.34 V Worst Case.

Rotor, Mesh and Fault Frequencies

$\pm 6.7\%$ typical, $\pm 9.7\%$ Worst Case

Bearing Frequencies

$\pm 6.7\%$ typical, $\pm 9.7\%$ Worst Case

Tower Sway

$\pm 0.16 \text{ m/s}^2$ (0.016 g) typical
 $\pm 0.23 \text{ m/s}^2$ (0.023 g) Worst Case

Kurtosis

$\pm 1\%$ 50 Hz to 10,000 Hz
 $\pm 3\%$ 1 Hz to 49.9 Hz

Generator Electrical Noise

$\pm 1\%$ 50 Hz to 10,000 Hz
 $\pm 3\%$ 1 Hz to 49.9 Hz

Crest Factor

Within $\pm 0.5\%$ of full-scale typical,
 $\pm 1.1\%$ Worst Case

Minimum Amplitude for Crest Factor, Skewness, and Kurtosis measurements

0.6 m/s² (0.06 g)

Alarming

Modes

5 modes + default mode

Modes are determined from
Generator Power

Mode 1: 25% to 40% power

Mode 2: > 40% to 55% power

Mode 3: > 55% to 70% power

Mode 4: > 70% to 85% power

Mode 5: > 85% power

Setpoints

2 Levels: Warning and Alarm

Time Delay

300 seconds (fixed) for all
measurements

Latching

All alarm statuses are latching

Dynamic Data

Asynchronous Waveform

8192 samples, 320 ms

Synchronous Waveform

8192 samples

4 revolutions, 2048 samples/rev

8 revolutions, 1024 samples/rev

16 revolutions, 512 samples/rev

32 revolutions, 256 samples/rev

64 revolutions, 128 samples/rev

Spectrums

Main Bearing

8 revolutions, 1024 samples/rev

3200 lines Sync Enveloped



Gearbox Stages

3200 lines Sync Enveloped
3200 lines Sync High Res
Number of revolutions and samples per revolution vary based on the selected asset.

Generator Inboard / Outboard

64 revolutions, 128 samples/rev
3200 lines Sync Enveloped
3200 lines Sync High Res

Tower Sway

15.625 Hz, 200 lines

Anti-Alias

-80 dB minimum

Update Rate

30 seconds

Historical Data Storage Rate

4 Hours

Data Storage

2 Weeks (typical, no alarms)

Keyphasor Signal Inputs

Speed Range

1 to 120,000 rpm
Limited to 2,000 rpm for Wind Turbines

Speed Resolution

1 to 100 rpm \pm 0.1 rpm
100 to 2000 rpm \pm 1 rpm

Gap

\pm 8.2 mV typical
 \pm 22.3 mV worst case

Supported Transducers

Acceleration Channels

TurningPoint TP100 Accelerometer

Keyphasor Channels

Turck Ni8-M18T-AP6X7M, externally powered
Bently Prox Probes

Oil Particle Sensors

GasTOPs
Macom

Proximity Channel (for Shaft Crack Detection)

Bently Prox Probe 3300 XL 11mm

60M100 System Environmental Specifications

Operating Temperature Range

-40 C to +70 C
(-40 F to 158 F)

Storage Temperature Range

-45 C to +85 C
(-49 F to 185 F)

Relative Humidity

0% to 95% non-condensing
Operating and Storage

Pollution Degree

Pollution Degree 2 (Working voltage < 30 Vrms or 60 Vdc)



Physical

Dimensions

8.88 X 5.89 X 2.17 inches [225 X
150 X 55 mm] (See Figure 1)

Weight

1.4 kg (3 lbs)

Mounting

Din Rail Mounting

Compliance and Certifications

EMC

Standards:

EN 61000-6-2 Immunity for Industrial
Environments

EN 55011/CISPR 11 ISM Equipment

EN 61000-6-4 Emissions for Industrial
Environments

European Community Directives:

EMC Directive 2004/108/EC

Electrical Safety

Standards:

EN 61010-1

European Community Directives:

2006/95/EC Low Voltage

For further certification and approvals information please visit the
following website:

<http://www.GEmeasurement.com/>

Ordering Information

For a detailed listing of country and product
specific approvals, refer to the *Approvals Quick
Reference Guide* (document 108M1756) located at
the following website: www.GEmeasurement.com.

**60M100: Bently Nevada 60M100 Condition Monitor
(Monitor Only)**

AA: Approvals

00 – Standard

60M100_KIT: Bently Nevada 60M100 Condition Monitoring System Kit

AAA: Configuration

XX1 – GE 1.X MW

XX2 – GE 2.X MW

XX3 – GE 2.3-107

XX4 – GE 2.5 MW PMG

020 – Vestas V82

022 – Vestas V110/V110 After Market

026 – Vestas V110/V110 Factory
Enclosure

028 – Vestas 3MW Onshore

BB: Approvals

00 – None

Spares

3701 Software Package with Options 3701/00-AA-BB-CC

AA: Order Type

01 – Initial Purchase

99 – SW Update DVD

BB: Licensing

00 – Update

01 – 200 Turbine Farm

02 – 33 Turbine Farm

CC: Software Version

01 – Latest†

†The 60M100 monitor is only compatible with software
version 1.9 or later.

3701 Server and Monitor with Options 3701/11-AA-BB

AA: Server Computers

00 – None

01 – Hi Perf Tower

02 – Hi Perf Rack

03 – Compact Server

04 – Compact Server (O & M
Building)

BB: Monitors

00 – None

01 – 19-Inch TFT Flat Panel



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Specifications and Ordering Information

Part Number 104M0791-01

Rev. B (6/16)

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Sensors and Cables**323394**Turningpoint TP100
Accelerometer
100 mV/g, 0.5 - 14,000 Hz**200355**Low Frequency Accelerometer
100 mV/g, 0.2 - 10,000 Hz**287844**Accelerometer Mounting Stud
1/4 -28 to M8x1.25 SST**284613-050**Accelerometer Cable, 15.2 m (50ft)
with straight connector**284613-030**Accelerometer Cable, 9.1 m (30ft)
with straight connector**284622-050**Accelerometer Cable, 15.2 m (50ft)
with right angle connector**284622-030**Accelerometer Cable, 9.1 m (30ft)
with right angle connector**138131**CAT5 Cable. Minimum cable
length is 3 feet. Maximum cable
length is 320 feet. Cable lengths
are 3, 6, 10, 25, 40, 50, 75, 85, 100,
120, 150, 200, 250, and 320 feet.**323314-01**Buffered output cable, 15-pin
DSUB to 7 SMA connectors**323314-02**Buffered output cable, 15-pin
DSUB to 7 BNC connectors**Accessories****283624**

Surge Protector

284005

Surge Protector Cover

104M4408-013701/60A to 60M100 Retrofit
Mounting Kit**Miscellaneous****04425545**Grounding Wrist Strap (Single use
only)

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Graphs and Figures

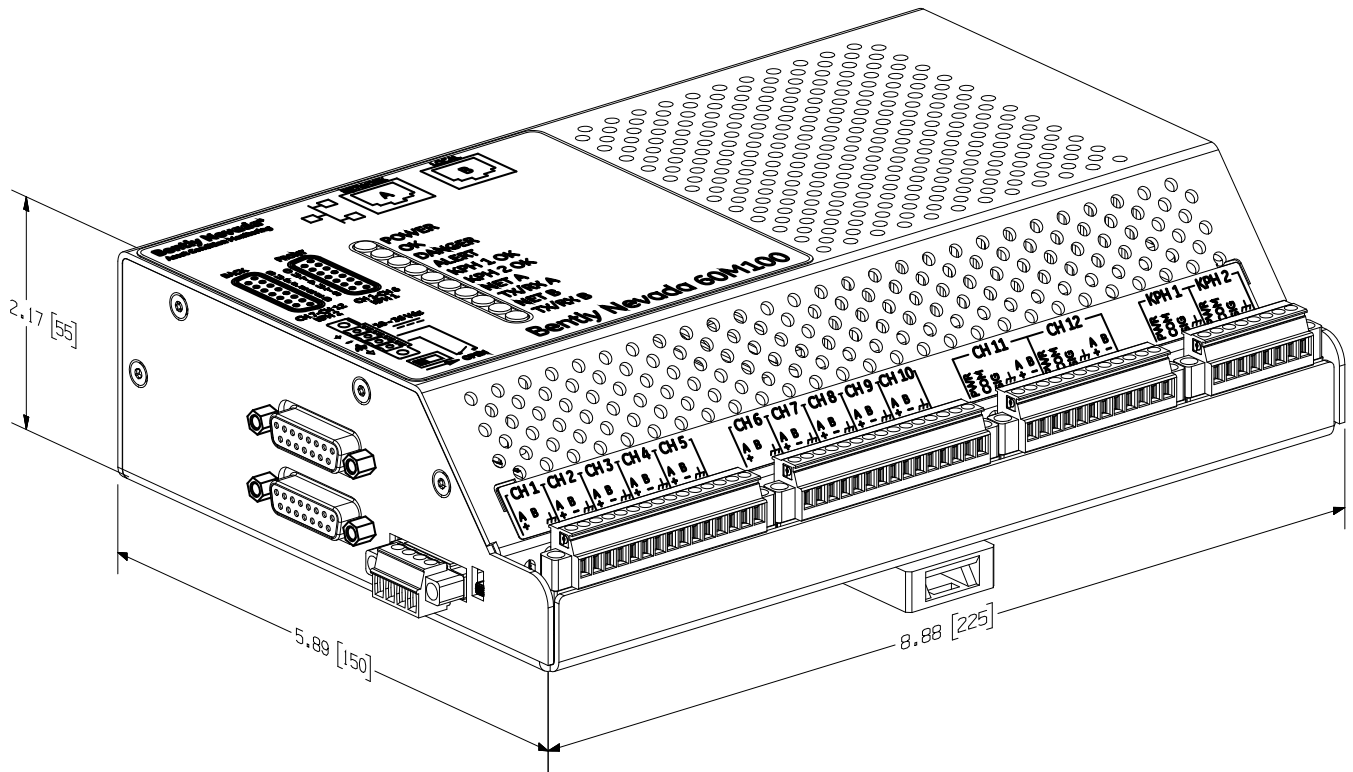


Figure 1: 60M100 Monitor Overall Dimensions

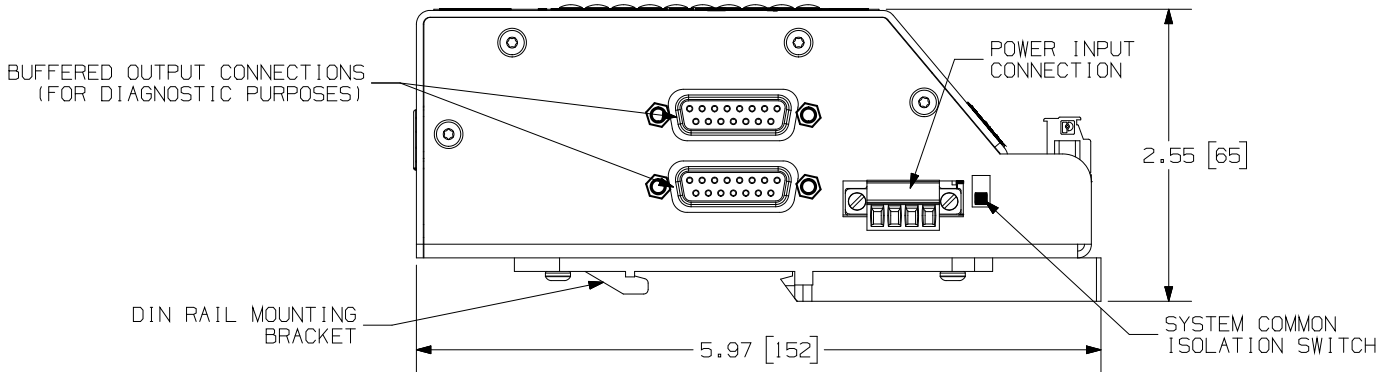


Figure 2: 60M100 Monitor Side View

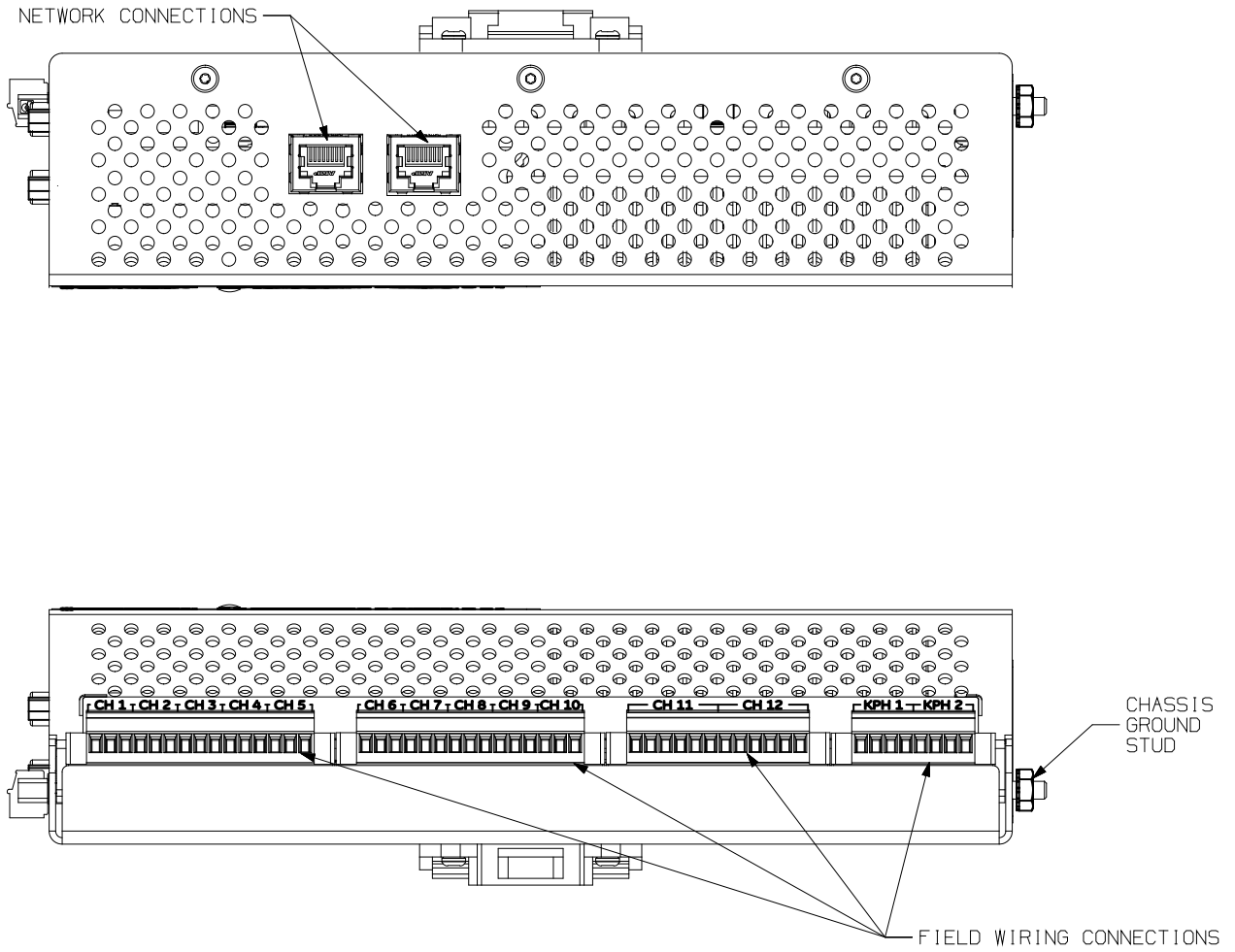


Figure 3: 60M100 Monitor Top and Bottom Views

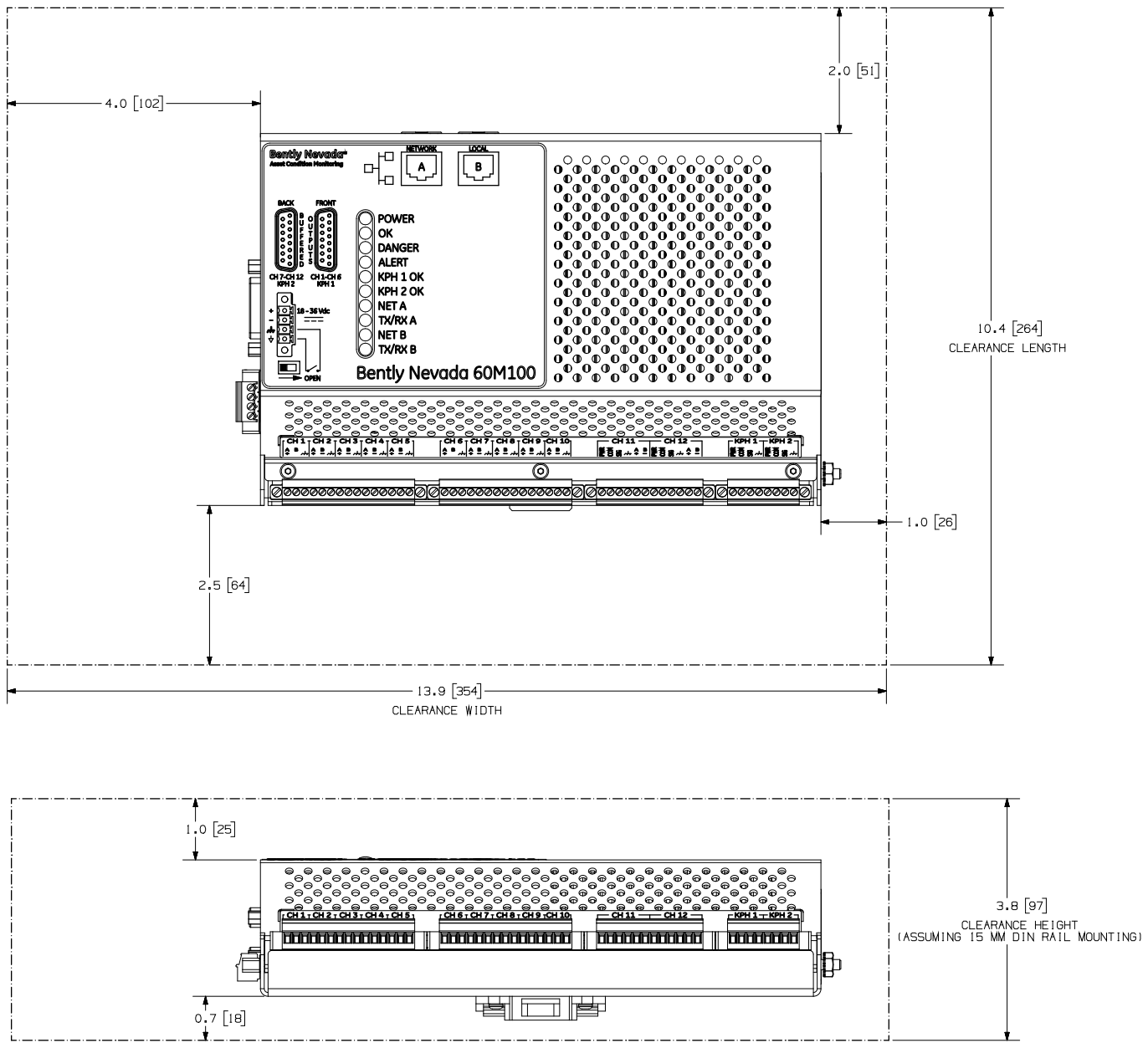


Figure 4: Recommended minimum clearance window for cable terminations and monitor cooling

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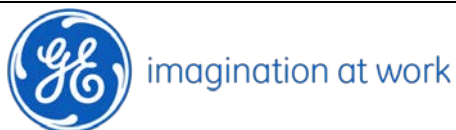
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