# DMV-100 Rotor Creep and Speed Detector

# Installation Manual

# Safety information

This manual contains information and warnings that must be observed to keep the instruments in a safe condition and ensure safe operation.

- To use VibroSystM instruments correctly and safely, read and follow all the safety instructions or warnings given throughout this manual.
- To avoid electric shock, personal injury, or death, carefully read the information under «Safety Information» before attempting to install, use, or service this instrument.
- In addition, follow all generally accepted safety practices and procedures required when working with and around electricity.
- For safe operation and to ensure that your system functions at its optimum capacity, the installation and adjustment process should be handled only by VibroSystM trained service specialists.
- Install and use this instrument only as specified in this manual, or the protection provided by this instrument might be impaired.
- Do not use the instrument in wet environments.
- Whenever it is likely that safety protection has been impaired, make this instrument inoperative and secure it against any unintended operation.
- Have this instrument serviced only by qualified service personnel.
- Never remove the cover or open the case of this instrument without first turning off the main power source.
- Never operate this instrument with the cover removed or the case open.
- Do not operate this instrument around explosive gas, vapor, or dust.

**Table 1: Safety and electrical symbols that appear in this manual and on the material**

| | |
|---|---|
| ⚠ | **Warning - Danger** - identify conditions or practices that could cause bodily harm, and result in damage to the measuring chain and other equipment to which it is connected. Conditions include a risk of electric shock (voltage > 30 $V_{DC}$ or $V_{AC}$ peak might be present). |
| ⚠ | **Caution** - identify conditions or practices that could result in permanent loss of data. |
| ❗ | Important information. |
| ⏚ | Electronics common - not linked to earth ground. |
| ⏚ | (Shield) cables shield-to-earth ground, frame or chassis terminal - linked to earth ground. |

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# 1. OVERVIEW OF THE DMV-100 ROTOR CREEP AND SPEED DETECTION SYSTEM



*Figure 1 : DMV-100 Rotor Creep and Speed Detection complete measuring chain*

The DMV-100 System is a complete measuring chain for detection of rotor motion (creep) and monitoring of machine rotational speed (RPM).

The DMV-100 System is comprised of:

| Qty | Description |
|-----|-------------|
| 1 | DMV-100 Monitoring Unit |
| 1 | DCC-631-10S-5/50 (DM-100 Series) Signal Conditioner |
| 1 | VM 3.12 air gap capacitive sensor |
| 1 | Sensor installation kit |
| 1 | 10 m (33 ft.) triaxial extension cable (from VM 3.12 sensor to DCC-631 conditioner) |
| 1 | 45 m (148 ft.) M12 connectorized power input and signal output cable (from DCC-631 conditioner to DMV-100 unit) |

## 2. INSTALLATION OF THE VM 3.12 AIR GAP SENSOR FOR MOVEMENT DETECTION

### 2.1 Preliminary considerations



*Figure 2 : VM 3.12 Air Gap Sensor*

- The VM 3.12 sensor is a flat, non-contact sensor using capacitive technology to measure the distance from its face to a target (typically, rotor poles in rotating electrical machinery).

- A single air gap sensor is needed for movement detection. The purpose of the movement detection system is solely to sense the passage of poles, regardless of the position of the rotor. The sensor may therefore be installed at any angular position.

- A triaxial extension cable connects the sensor to a signal conditioning module. The output produced by the module is a linearized 4 to 20 mA signal which can be sent to an acquisition unit, control unit, or any other instrument.

- The sensor detecting surface must be parallel to the target surface. The sensor must be glued against the stator laminations at a position where it will face the plane area of the rotor poles, usually beneath the second ventilation hole.

- The length of the integral cable (50 cm *[19.7 in.]*) limits the depth at which the sensor can be glued, as the connector must remain outside the airgap.

- The integral cable must also be glued to the stator, and covered with a bead of silicone for protection.

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⚡ **Warning - Danger** ⚠ **Caution**

- **Integral cables must be installed on the stator core or a grounded surface to avoid disrupting the equipotential.**
- **Never install triaxial cables on high voltage components.**
- **Never install the sensor over a wedge, always install on stator core laminations.**
- **Avoid using silicone or PVC based products and components when installing the sensors in an hydrogen-cooled machine.**

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⚠
- Handle the sensor with great care.
- Never pull on the triaxial cable or on the connector.

⊘
- Do not apply paint or silicone on the sensor sensing surface.

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### 2.1.1 Supplies needed



*Sensor installation kit, sandpaper and cleaning rags*

- • clean dry cloth
- • fine sandpaper (with non metallic particles)
- • a sensor installation kit including:
  - glue (Loctite 330) and its activator (Loctite 7387) or equivalent
  - silicone (3145RTV) or equivalent

## 2.2 Positioning the air gap sensor
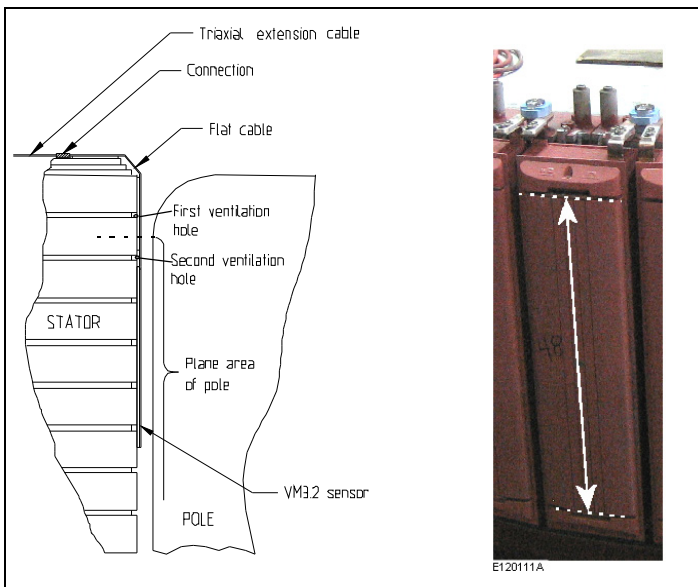


*Sensor beneath second ventilation hole and facing flat portion of rotor*

- • The air gap sensor must be placed beneath the second ventilation hole. When the generator is in rotation, the whole surface of the sensor must face in parallel the flat portion of the moving rotor poles.
- • The flat portion of a rotor pole is the laminated steel core or solid steel body, without the plates for mounting the pole to the rotor rim.

## 2.3 Step by step installation of the VM 3.12 Sensor

### 2.3.1 Preparation of Stator Surface

After identifying and marking the locations where the sensor should be installed, clean the stator surface to remove all dust deposits. This step must not be neglected as sensor adherence depends on the preparation of the surface.

1.  Clean the stator surface with a clean dry cloth.

2.  Run fine sandpaper on the stator surface, straight along the laminations, just to remove surface dirt as preparation for glueing. Make sure only non-metallic paper is used.

3.  After sanding, clean the stator surface again with a dry cloth.

### 2.3.2 Glueing the VM 3.12 Sensor

| ⚠️ Caution |
|---|
| • **Sensors must be glued on stator core laminations, and NEVER ON THE WEDGES.**<br>• **Handle the glue with care to avoid skin contact.**<br>• The glue bonds and sets quickly. All preparation must be completed before applying the glue. |



1.  If needed, clean the back of the sensor with a clean dry cloth.

2.  Apply glue on the back surface of the sensor. Spread glue to a thin and even coat, which will not run down when the sensor is pressed against the stator.
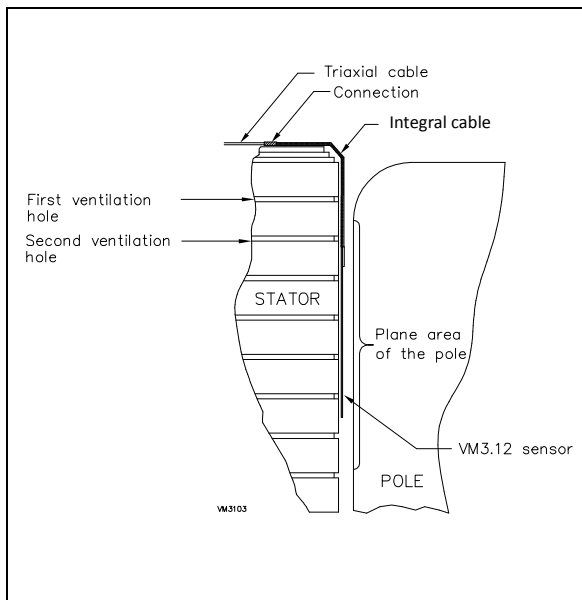
3.  Apply the catalyst over the glue on the sensor.

4.  Position sensor on the clean surface of the stator. The sensor must face the plane area of the rotor poles, which usually starts after the second ventilation hole.

5.  Pivot sensor slightly to blend the catalyst into the glue and to spread the mix evenly, and then reposition vertically. Hold in a straight, upright position for 60 seconds.

6.  Temporarily tape the flat cable to the stator so that it does not get pulled inadvertently.

*Figure 3 : Lateral view of VM 3.12 sensor installed below second ventilation hole*

You will need to glue the integral flat cable to the stator, but only after having completed the installation of the extension triaxial cable. Finally, you must also apply a fine bead of silicone around the sensor edges and over the integral cable to prevent damage from dirt and particles, and to protect the sensor edges from deterioration.

## 2.4 VM 3.12 Sensor - General specifications

**Operation**

- Linear measuring range with

| | | |
|---|---|---|
| DCC-631-10S-5/50-ala2/p | 5 to 50 mm | *[197 to 1968 mils]* |
| LIN-331-10J-2/20 | 2 to 20 mm | *[79 to 787 mils]* |
| LIN-331-10J-5/35 | 5 to 35 mm | *[197 to 1378 mils]* |
| LIN-331-10S-2/20 | 2 to 20 mm | *[79 to 787 mils]* |
| LIN-331-10S-5/35 | 5 to 35 mm | *[197 to 1378 mils]* |
| LIN-331-15Q-2/20 | 2 to 20 mm | *[79 to 787 mils]* |

- Frequency response                    limited by the linearization module
- Interchangeability                      ± 5 %

**Connection**

- Integral cable
  - Type                                      coaxial
  - Length                                  50.0 cm         *[19.68 in.]*
  - Connector                            SMA plug (male contact)

**Environmental**

- Temperature range
  - Operation:                           0° to 125°C     *[32° to 257°F]*
  - Storage:                              0° to 125°C     *[32° to 257°F]*
- Magnetic field                          up to 2 Tesla (50 Hz or 60 Hz)
- Dust and oil contamination        films have no effect on performance
- Humidity                                 up to 95%, non condensing

**Physical characteristics**

- Dimensions
  - Height (sensing surface only)    220.5 mm      *[8.68 in.]*
  - Width                                   33.25 mm      *[1.30 in.]*
  - Thickness                             1.77 mm        *[0.07 in.]*
  - Connector assembly diameter   7.92 mm        *[0.312 in.]*

**DIMENSIONS**

Coaxial Integral Cable : 50 cm *(19.68 ")*

TOP VIEW

33.25 mm
*(1.30")*

VM 3.1

VibroSyst M

220.50 mm *(8.68")*
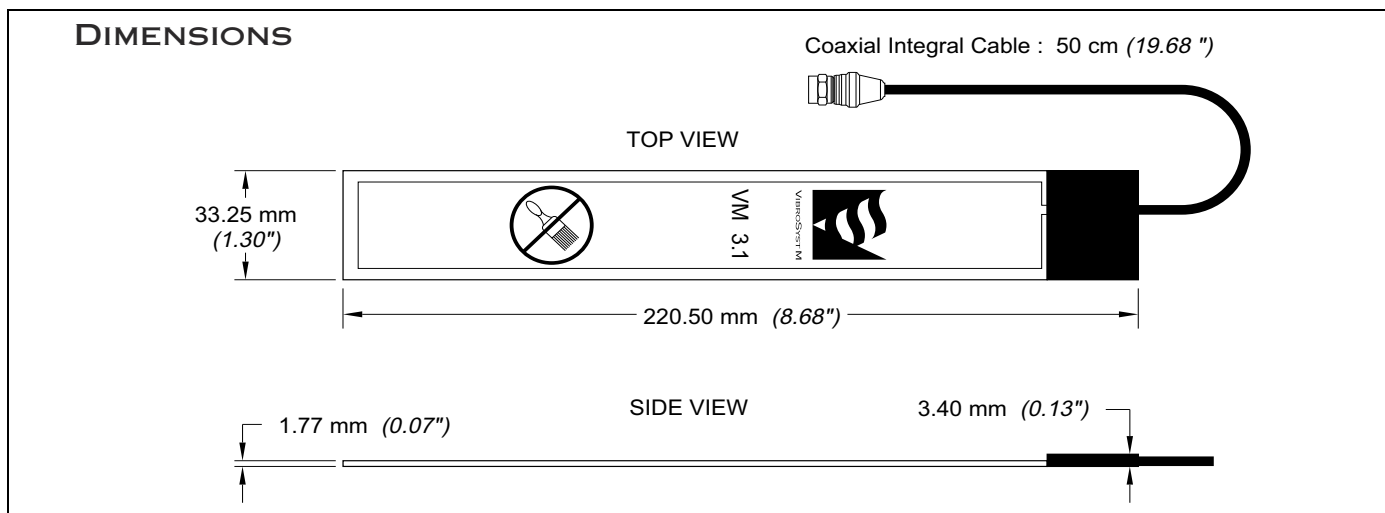
SIDE VIEW

1.77 mm *(0.07")*

3.40 mm *(0.13")*

*Figure 4 : Dimensions of the VM 3.12 sensor*

# 3. INSTALLATION OF THE TRIAXIAL EXTENSION CABLE

## 3.1 Preliminary considerations

• The cable type to be used is determined by the sensor type. It is very important that you use the triaxial extension cable sent with the sensor.

| ⚠ Warning - Danger     ⚠ Caution |
|---|
| **Never install triaxial extension cables on high voltage components.** |

| ⚠ Caution |
|---|
| **Triaxial extension cables are calibrated and must never be cut or altered.** |

• Installation of the triaxial extension cable usually follows that of the sensor.

• Before installing the triaxial extension cable, it is important to determine where the enclosure (containing one or two modules) will be installed, keeping in mind the length of the triaxial extension cable. The cable must be protected by a combination of conduit, protective tubing, and heat-shrinkable tubing.

> **The ground lugs must be electrically connected on BOTH ends of the triaxial extension cable. On the sensor side, the ground lug must be connected to the stator frame. On the signal conditioning module end, the ground lug must be connected to the module ground screw.**

• Triaxial extension cables are terminated with an SMA plug (male contact) connector on the signal conditioning module end, and an SMA jack (female contact) connector on the sensor end.



*Figure 5 : Securing the protective tubing and coupling*
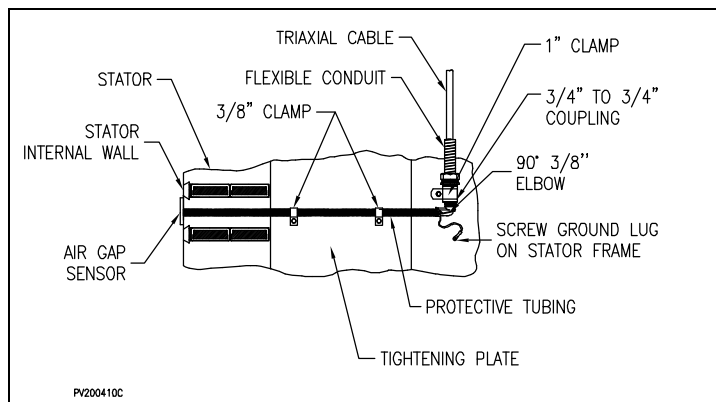
Cable clamps must be used to secure all components subjected to vibrations. This step of the installation is essential to prevent damage from wear by abrasion.

Use clamps to secure the protective tubing and elbow assembly to the top of the stator. Refer to *Figure 7 : "Preparing holes for the cable clamps"*.
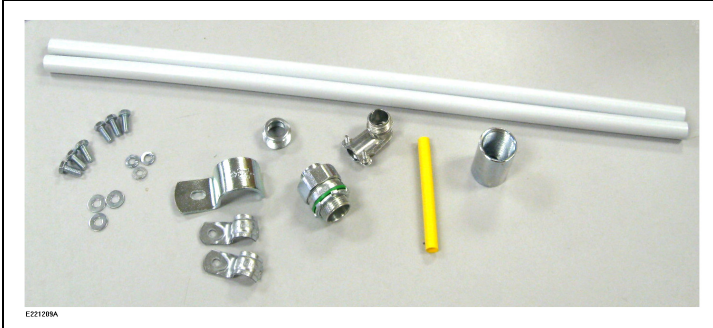
### 3.1.1 Supplies needed



*Figure 6 : Installation kit for one air gap sensor*

- triaxial extension cable installation kit, comprised of:
  - two (2) lengths of protective tubing 1/2 x 24"
  - one (1) 3/4" watertight connector
  - one (1) 90° 3/8" elbow
  - one (1) 3/4" to 3/4" coupling
  - one (1) 3/4" to 1/2" reducer
  - one (1) piece of 3/8" heat-shrinkable tubing
  - three (3) hex screws 1/4-20 x 5/8
  - three (3) metric hex screws M6-1,00 x 16mm
  - three (3) 1/4" flat washer
  - three (3) 1/4" spring lock washer
  - two (2) 3/8" cable clamps for protective tubing
  - one (1) 1" cable clamp for elbow assembly
- flexible conduit (not supplied)

### 3.1.2 Tools needed

- assorted drill bits and taps
- heat gun
- cutters or saw for protective tubing
- fish tape
- standard wrench set
- assorted screwdrivers

## 3.2 Step by step installation of the triaxial extension cable

### 3.2.1 On site preparation

Determine the run of the flexible conduit, from the location of the elbow assembly, on top of the stator frame, to the enclosure. Always keep in mind the length of the triaxial extension cable.

| ⚡ Warning - Danger ⚠ Caution |
|---|
| **Triaxial extension cables must be installed on the stator frame or a grounded surface to avoid disrupting the equipotential, and prevent the formation of surface partial discharges and arcing.** |
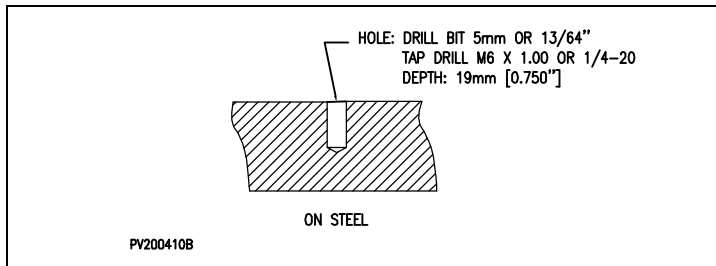
*Figure 7 : Preparing holes for the cable clamps*

1. Prepare the holes for the cable clamps.

### 3.2.2 Installation of triaxial extension cable - sensor end

| ⚠ Warning - Danger     ⚠ Caution |
|---|
| **The protective tubing supplied with the installation kit must be installed on the stator core or stator frame (ground potential).** |



* Note: Two ground wires may be present if the sensor cable is also equipped with a ground wire.

*Figure 8 : Assembly on top of stator frame*

1. On top of the stator, install a length of protective tubing to protect the triaxial extension cable and its connection to the sensor.

   Cut the tubing to the right length so that it will not extend beyond the stator edge. The tubing can be heated and bent. Install the tubing in close contact, as much as possible, with the top of the stator frame.

*Figure 9 : Elbow assembly*

TO CONDITIONER
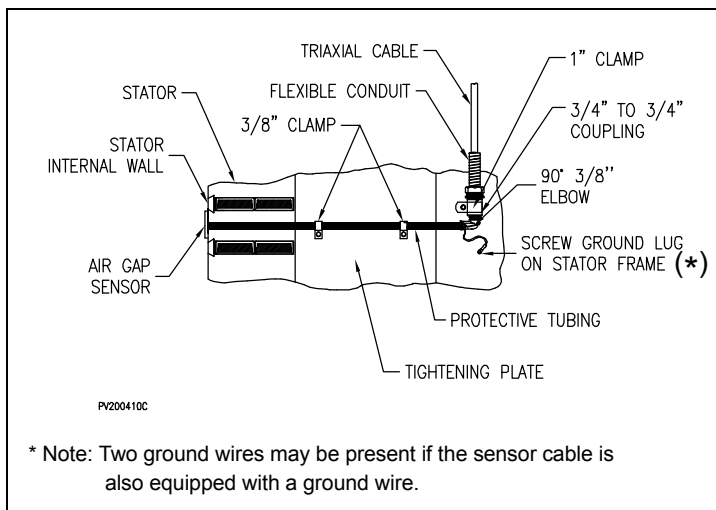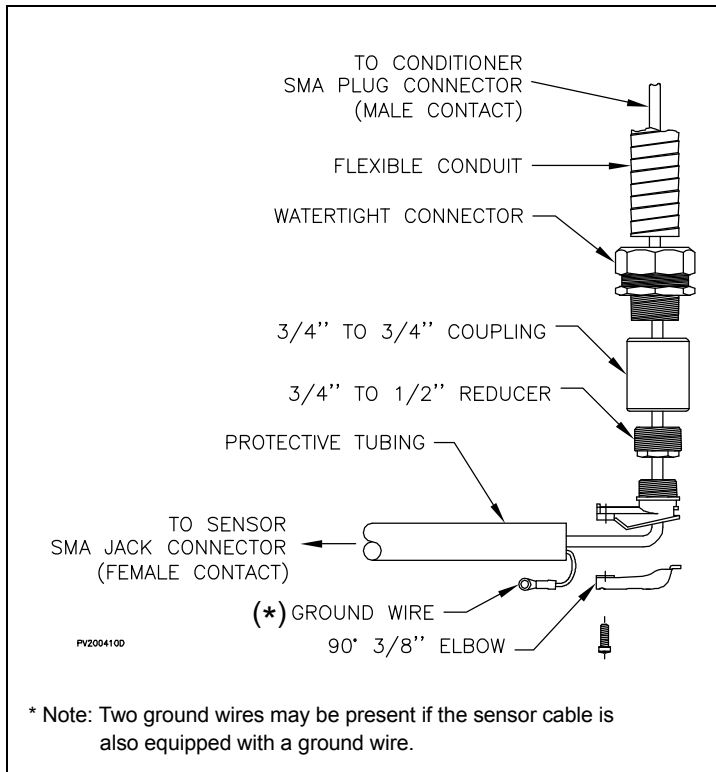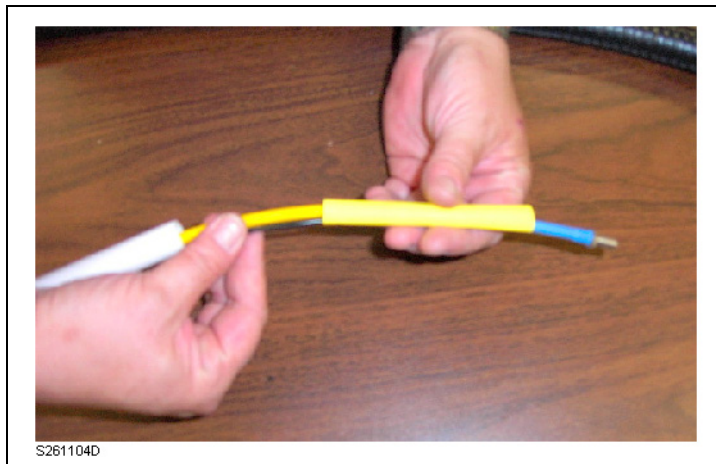SMA PLUG CONNECTOR
(MALE CONTACT)

FLEXIBLE CONDUIT

WATERTIGHT CONNECTOR

3/4'' TO 3/4'' COUPLING

3/4'' TO 1/2'' REDUCER

PROTECTIVE TUBING

TO SENSOR
SMA JACK CONNECTOR
(FEMALE CONTACT)

(*) GROUND WIRE

90° 3/8'' ELBOW

PV2004I0D

* Note: Two ground wires may be present if the sensor cable is also equipped with a ground wire.

2. Attach the 3/4 to 3/4 coupling and the 3/4 to 1/2 reducer to the 90° 3/8" elbow. Temporarily leave the cover of elbow open, to allow pulling the triaxial extension cable.

3. Carefully pull the end of the triaxial extension cable terminated with a SMA jack (female contact) into the elbow assembly and protective tubing. Use a fish tape if needed.

   Pull out just enough extra length to work on the connection, without pulling the ground wire completely into the protective tubing.

   If the sensor cable is also equipped with a ground wire, this ground wire will have to be pulled into the protective tubing and connected to the ground structure at the same location as the triaxial extension cable ground wire.



*Figure 10 : Slipping on a piece of heat-shrinkable tubing*

S261104D

4. Slip a piece of heat-shrinkable tubing on the portion of triaxial extension cable sticking out of the protective tubing,

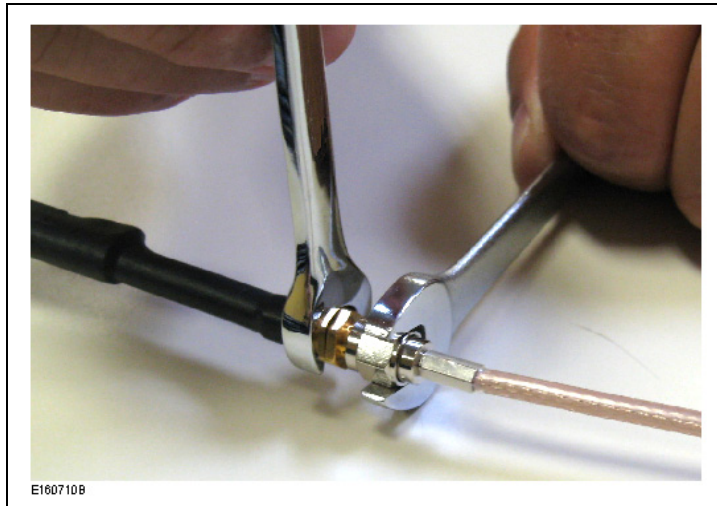*Figure 11 : Tightening the SMA plug and SMA jack connection*



*Figure 12 : Heating the heat-shrinkable tubing*



*Figure 13 : Pulling the SMA connection inside the protective tubing*

5. Attach the SMA plug from the sensor integral cable to the SMA jack at the end of the triaxial extension cable. Use two 8mm (or *[5/16"]*) flat wrenches to tighten the connection firmly.

> ⓘ **Recommended connection torque: 1.7 Nm *[15 in-lb]***

6. Slide the heat-shrinkable tubing over the connection and shrink the tubing with a heat gun.

> ⓘ **The heat-shrinkable tubing must be placed over the connection to prevent accidental short-circuits between connectors and metallic parts such as flexible conduit, stator frame, etc., and to secure the connector.**
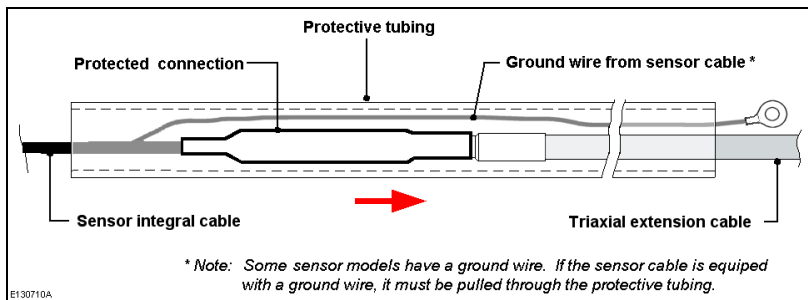
7. Pull the connection inside the tubing, just enough to straighten the cable.

   If the sensor integral cable is equipped with a ground wire, also pull this wire through the protective tubing.
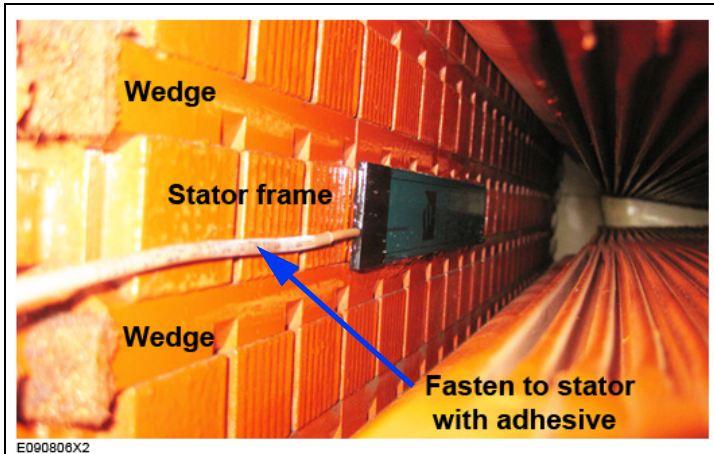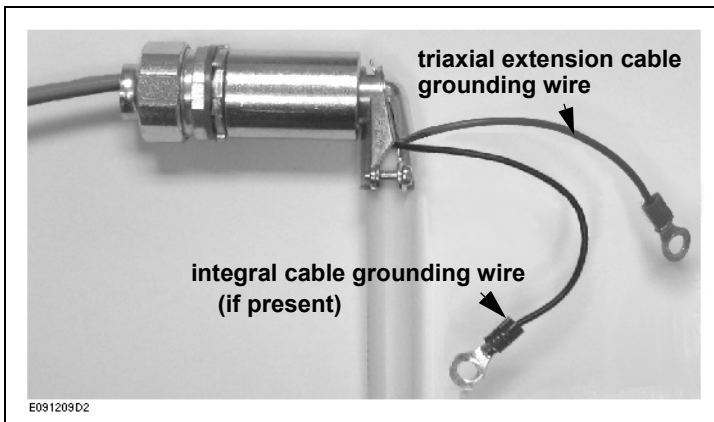
*Figure 14 : Fastening integral cable to stator*


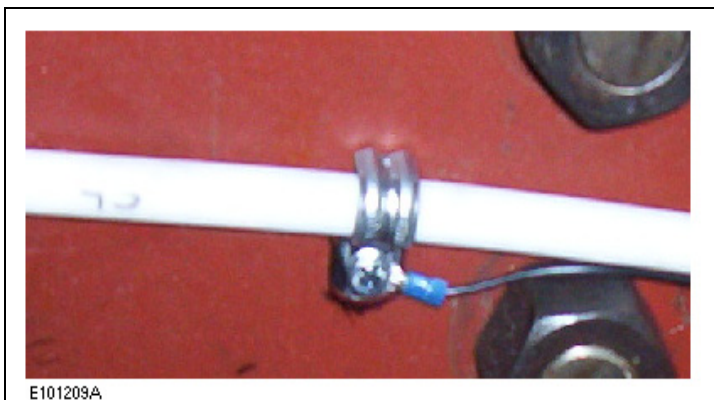
*Figure 15 : Pulling ground wire out of the elbow assembly*



*Figure 16 : Attaching a grounding wire to the structure through a cable clamp*

8.  Using instant adhesive (Loctite 404 or equivalent), glue the sensor's integral cable against the stator, from the sensor to the tubing opening.

    Remove the slack between the protective tubing and the elbow assembly. Leave just enough looseness to allow for thermal expansion and contraction.

9.  Install the cover on the 90° 3/8" elbow, and attach the assembly to the protective tubing.

    Let the triaxial extension cable grounding wire exit the assembly through the open space that remains between the body and cover, near one of the screws. If the sensor integral cable is equipped with a ground wire, also pull this wire through the open space.

    The elbow must be firmly clamped to the protective tubing.

10. The grounding wire(s) must be attached to the grounded structure.

> ❗ **Adequate installation of the ground wire to the grounded structure is essential for reliability of results.**

It is common practice to attach the ground lugs to the structure through a cable clamp. When doing this, however, make sure that the connection point is at the same potential level as the stator frame.

> ❗ **Note: Do not cut or extend the grounding wire.**
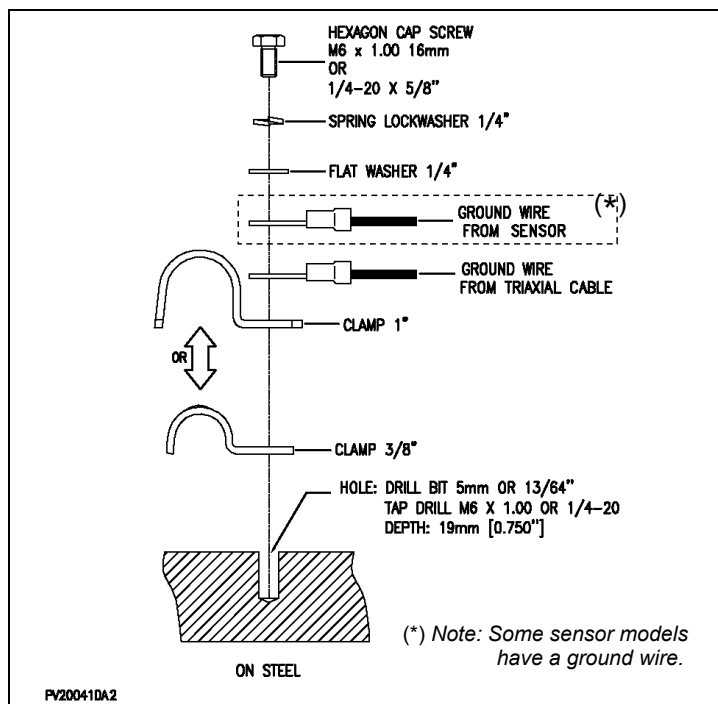
Figure 17 : Securing the cable clamps

11. Install the cable clamps and grounding wire.

    If the sensor cable is also equipped with a ground wire, this ground wire will have to be connected to the ground structure at the same location as the triaxial extension cable ground wire.

    Use threadlocker (Loctite 242 or equivalent) to secure the hexagon cap screws

### 3.2.3  Silicone application

| ⚠ Caution |
|---|
| ⚠<br>⌀ | • **DO NOT APPLY SILICONE IN HYDROGEN-COOLED LOCATIONS.**<br>• When applying silicone, keep the detection surface of the sensor clean and free of silicone. |



*Figure 18 : Application of silicone*

1. Cover the sensor's integral cable with silicone, from the top of the sensor to the edge of the protective tubing.

   To prevent cable deterioration, and dust and debris from entering, apply silicone inside the tubing to form a plug.

### 3.2.4 Installation of triaxial extension cable - signal conditioning module end



1. Unroll the flexible conduit, following the planned course of the triaxial extension cable. Cut the conduit to desired length.

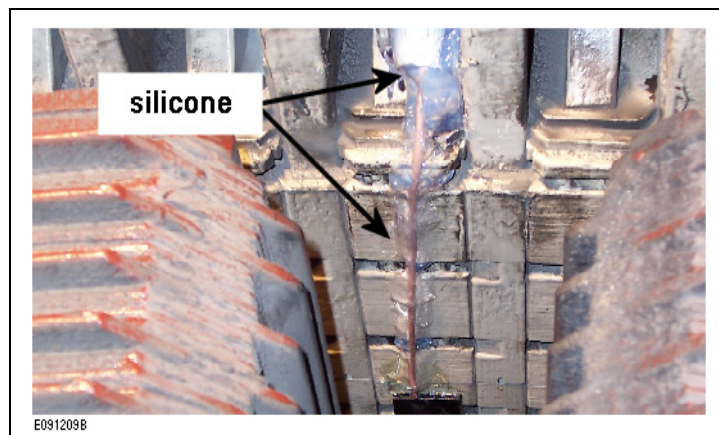   At the enclosure end, attach the flexible conduit to the 19mm (3/4") liquidtight connector.

   > **!** Avoid installing two triaxial extension cables or more in parallel close to one another. Keep cables at least 30 cm *[12 in.]* apart.

*Figure 19 : Flexible conduit connection to enclosure*

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⚠️ **Caution**

To prevent damage to the cable when pulling it into the conduit:

- protect the connector by wrapping electrical tape over it
- proceed slowly
- avoid placing too much tension
- do not force beyond the minimal bending radius (5 cm *[2.5"]*).

---

2. From the enclosure, use a fish tape to pull the triaxial extension cable (conditioning module end) into the flexible conduit.



3. Remove the nut, bushing, and inner retainer from the elbow assembly, and install these components on the sensor end of the flexible conduit.
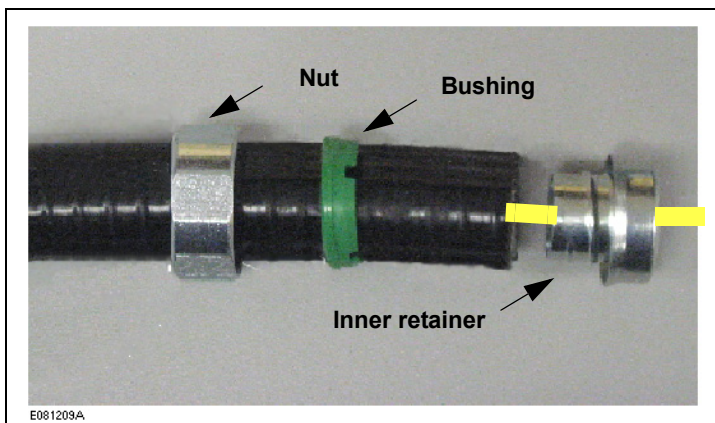
*Figure 20 : Flexible conduit connector assembly*
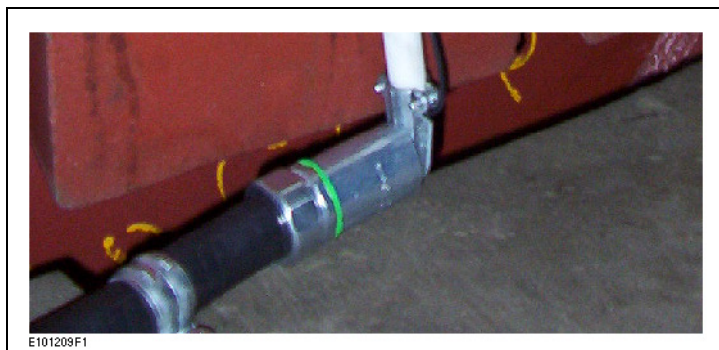
*Figure 21 : Flexible conduit attached to elbow assembly*

4. Attach the flexible conduit to the elbow assembly, and tighten firmly.



*Figure 22 : Excess cable stored in enclosure*

5. Excess cable can be coiled and stored in the enclosure.

> ❗ **Coil the cables individually, and keep the coils apart inside the enclosure.**

## 3.3  General specifications of the triaxial extension cables

| Cable type | Description | Length | Connector type | |
|---|---|---|---|---|
| | | | on sensor end | on conditioner end |
| 10S | Triaxial "S" SMA-SMA | 10 m *[33.5 ft.]* | SMA | SMA |
| Note: Due to the calibration process used, the triaxial cable may be shorter than the specified nominal length. The minimum length of a 10S type cable is 9.5 m *[31.2 ft.]*. | | | | |

![VibroSystM logo]

# 4. INSTALLATION OF THE DCC-631 MODULE FOR THE DMV-100 SYSTEM

## 4.1 Preliminary considerations



The DCC-631 module is a specialized command instrument which controls an auxiliary power relay to announce rotor movement. An absence of air gap variation over a period of at least 25 seconds indicates the rotor has stopped moving, and the DCC-631 module then outputs $+24V_{DC}$ to the auxiliary relay. The power to the auxiliary relay is instantly cut upon detection of signal variations from the VM 3.12 air gap sensor.

*Figure 23 : DCC-631 module from the LIN-300 Series*

- The VM3.12 sensor connects to the DCC-631 module through a 10S Type triaxial extension cable. The nominal length of the 10S triaxial cable is 10m (*[32.8 ft.]*). The effective length of this cable may however vary by + or - 0.5m (*[1.6 ft.]*). The length of the cable is set during factory calibration and must not be altered.
- The DCC-631 module must be installed close to the stator of the monitored machine.
- **The casing of the DCC-631 module must be grounded.**
- The cast aluminium casing is not water-proof. An additional protection against dust, oil, and water is needed, particularly in harsh conditions. The DCC-631 module should therefore be installed in a water-tight enclosure or cabinet.
- A standard 45 m *[145 ft.]* M12 connectorized cable is used and serves double duty:
  - carry in the $+24V_{DC}$ supply needed to power the DCC-631 module
  - carry out the voltage output signal which drives the auxiliary relay for creep alarm annunciation.
- The location where the DCC-631 module will be installed must meet certain requirements. Before proceeding with the installation, make sure the selected location allows:
  - drilling 4 mounting holes for mechanical installation of the DCC-631 module;
  - connection of the triaxial extension cable (from the VM 3.1 sensor);
  - connection of the power input and signal output M12 connectorized cable to/from the $+24V_{DC}$ power supply and auxiliary relay.

## 4.2  Installation of the DCC-631 module

### 4.2.1  Supplies needed

Mounting screws are not included. The following must be provided:

- 4 mounting screws
- 4 lock washers
- 4 nuts (if mounting holes are not tapped)

### 4.2.2  Tools needed

- drill and assorted bits (and tapping tools if mounted without nuts)
- screwdriver assorted to the mounting screws
- pliers or flat wrench for nuts, if used

### 4.2.3  Mechanical installation of the casing
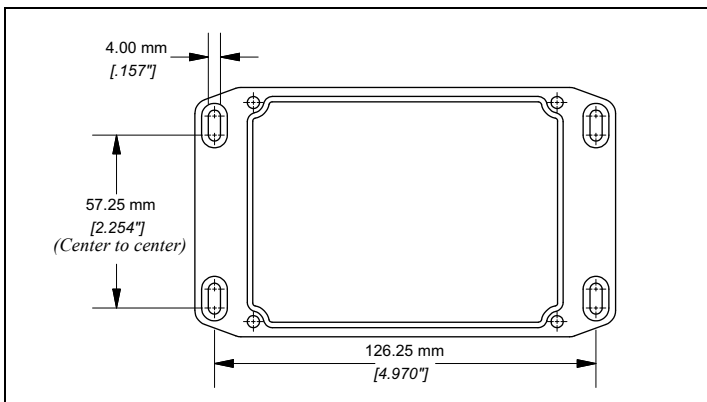


1. Drill four holes on the mounting surface as shown in the adjoining drawing.

2. Use screws and lock washers to firmly set the casing in place.

*Figure 24 : Holes location for DCC-631 module*

## 4.3  Connecting the cable to the DCC-631

The triaxial extension cable connects to the SMA socket and grounding screw. The standard M12 cable for power input and signal output connects to the M12 socket.



*Figure 25 : Cables connected to the DCC-631 module*

1. Insert the SMA male connector and engage by turning clockwise.

> **!**  **Recommended SMA connection torque: 1.7 Nm *[15 lb-in]***

2. Insert the tooth lock washer, the round lug, the spring lock washer and the nut onto the grounding bolt. Screw the nut firmly to ensure the grounding connection.

> **!**
> • **Recommended grounding connection torque: 2.8 Nm *[25 lb-in]***
> • **The ground lug must not come in contact with neither SMA connector nor M12 connector.**

**Table 1: DCC-631 module M12 connector configuration**



| Position | Wire color | Designation |
|---|---|---|
| 1 | Brown | +24 $V_{DC}$ supply |
| 2 | White | (future use) |
| 3 | Blue | Common |
| 4 | Black | Creep detection signal |
| 5 | Gray | Pulse (1/pole) |
|  | Shield | (ends at M12 connector plastic body |

## 4.4 LED functionality
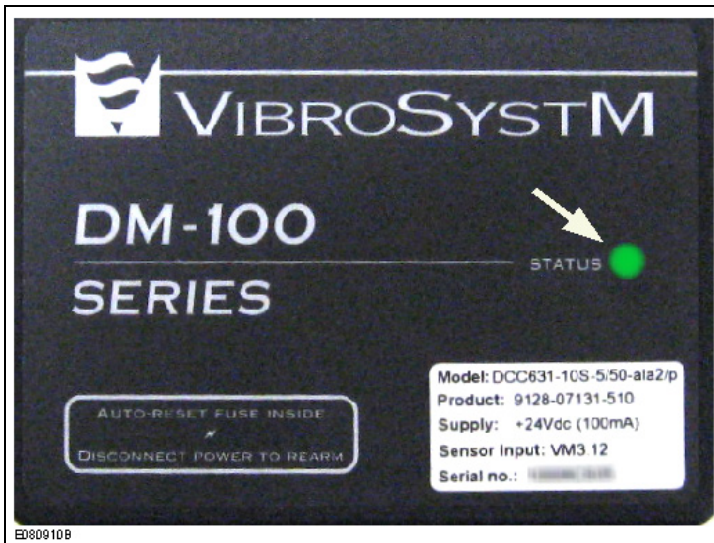


A colored LED provides a visual clue to the status of the DCC-631 module.

The sequence at startup is as follows:

1. an orange flash, followed by
2. a green flash, followed by
3. a green or red pulsation.

- A green pulsation (one brief flash per second) indicates normal operation (Status OK).
- The LED turns red and repeats a sequence of pulses to indicate an error condition:

Error condition # 1: the LED turns on for one second, followed by one brief flash, to indicate that the sensor is either not connected, or the distance to the target is beyond the maximal detection range

Error condition # 2: the LED turns on for one second, followed by two brief flashes, to indicate that the distance to the target is below the minimal detection range.

## 4.5 DCC-631 Signal Conditioning Module - General specifications

**Operation**

| | |
|---|---|
| • Matching sensor | VM3.12 |
| • Matching extension cable | 10S |
| • Measuring range | 5 to 50mm *[197 to 1968 mils]* |
| • Output signal | |
|   - Machine in rotation | 0 $V_{DC}$ |
|   - Machine stopped | +24$V_{DC}$, 60 mA |
|   - From stop to rotation | |
|      Response delay | instantaneous |
|      Air gap variation | > 5 mm *[ > 197 mils]* |
|   - From rotation to stop | |
|      Response delay | after a 25 seconds delay |
|      Air gap variation | < 5 mm *[ < 197 mils]* |
| • 1/P Output Signal | |
|   - Pole | < 50% of range, contact closed |
|   - Between poles | > 90% of range, contact open |
| • Accuracy | < 5% of reading |
| • Repeatability | ± 0.6% of reading |
| • Interchangeability | ± 5% of reading |
| • Frequency response | DC to 1.2 kHz (-3dB) |
| • Temperature drift | < 500 ppm/°C |

**Power requirement**

| | |
|---|---|
| • Voltage | +24$V_{DC}$ ±10% |
| • Consumption | 90 mA typical (+24$V_{DC}$) |
| • Protection | auto-reset fuse |

**Connections**

| | |
|---|---|
| • Triaxial extension cable | SMA socket and grounding screw |
| • Power & output cable | M12 socket |

**Environmental**

| | |
|---|---|
| • Temperature: | |
|   - Operation | 0° to 55°C *[32° to 130°F]* |
|   - Storage | 0° to 85°C *[32° to 185°F]* |
| • Humidity | Up to 95%, non condensing |

**Physical characteristics**

- Module body                                Die cast aluminium compact casing body
- Dimensions

| | | |
|---|---|---|
| - Height | 44.5mm | *[1.75 in.]* |
| - Width | 82.5mm | *[3.25 in.]* |
| - Length | 139.5mm | *[5.5 in.]* |

# 5. INSTALLATION OF THE DMV-100 UNIT

## 5.1 General description of the DMV-100 Unit

DMV-100 units are designed to monitor the movement of rotors with **salient poles**, using the signals received from a DCC-631 air gap measuring chain.

A VM3.12 sensor and DCC-631 Signal Conditioning Module continuously monitor variations of the air gap as rotor poles pass in front of the sensor. Any variation of more than 5 mm is considered to be an indicator of the end or start of a rotor pole. Even during the passage of a single pole in front of the sensor, curved areas on the pole may cause the air gap to change. The movement recorded in this situation is as significant as the detection over a physical half-pole.

When air gap variations fall below 5 mm for at least 25 seconds, the DCC-631 signal conditioning module then outputs a continuous $24V_{DC}$ signal, indicating the machine has stopped. This signal is used by the DMV-100 Unit to actuate an internal control relay. Contacts of this relay can be used to control remote annunciation equipment, to either confirm that the machine is idle, or set off an alarm to notify of rotor movement.

In addition to motion detection, the DCC-631 measuring chain sends a 1/pole pulse to the DMV-100 unit for display of real-time machine speed (RPM) through a programmable digital speed display unit. A 4-20 mA RPM-proportional signal output is also available at the back of the DMV-100 unit for remote metering or acquisition equipment.

The system safeguards against unexpected movement of the rotor as follows:

- The DCC-631 Signal Conditioning Module continuously monitors the machine in normal operation. The machine is considered *idle* if air gap variations remain below 5 mm for at least 25 seconds.
- When the machine becomes idle, the DCC-631 signal conditioner outputs a continuous $24V_{DC}$ signal , the internal relay in the DMV-100 unit is energized, and the green LED indicator on the DMV-100 unit labeled "ARRET/STOP" lights up. The system will maintain this state as long as the machine remains idle.
- As soon as the rotor moves, air gap variations of 5 mm and more are detected. The DCC-631 signal conditioner output signal immediately falls to $0\ V_{DC}$, the DMV-100 Unit internal relay becomes de-energized, and the red LED indicator on the DMV-100 Unit labeled "ROTATION" lights up. When the DMV-100 unit is properly wired to annunciation equipment, this situation triggers an alarm.
- If the integrity of the measuring chain is broken,  the red LED indicator labeled "ROTATION" lights up and the DMV-100 Unit internal relay becomes de-energized.

### 5.1.1 Overview of the DMV-100 Unit main components



The unit is designed to be installed in a properly ventilated rack mount enclosure. Overall enclosure dimensions are:

483 W x 305 D x 89 H (mm)

19" W x 12" D x 3.5" H (inches)

*Figure 26 : DMV-100 Rotor Creep and Speed Detection Unit*



*Figure 27 : Front panel of the DMV-100 rack-mount unit*

**1**   **Red LED "Rotation"**

This red indicator lights up as soon as the system detects rotor movement, and remains lit until the machine becomes idle again.

**2**   **Green LED "Stop"**

This green indicator lights up when the system stops detecting movement, and remains lit as long as no motion is detected.

**3**  **Speed Display Unit and Keypad**



*Figure 28 : Speed Display unit*
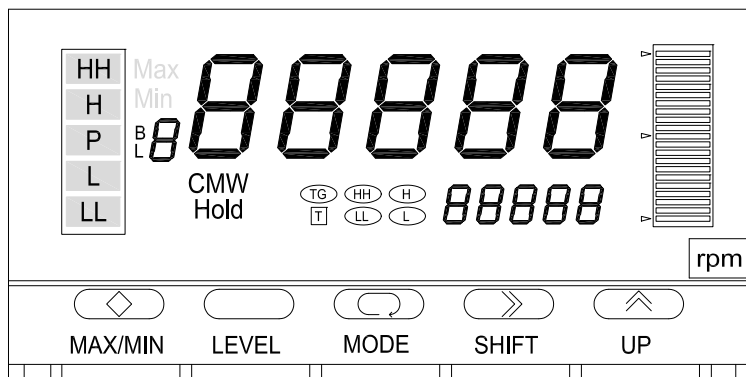
The five-digit display unit shows machine speed over a programmed range.

A field setup procedure is required prior to operation. The user must enter design-specific information such as the number of poles. The five button keypad allows browsing through display and configuration parameters. On-screen keywords guide users during setup (refer to *5.4 "Initial setup of the DMV-100 System"*).
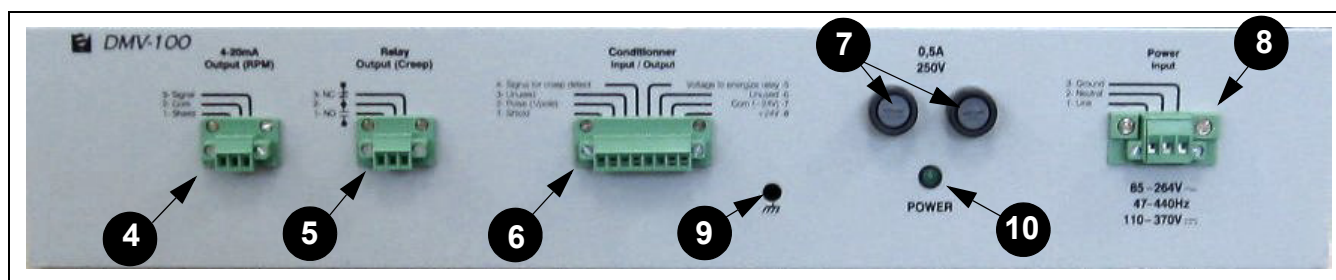


*Figure 29 : Back panel of the DMV-100 rack-mount unit*

**4**  **4-20 mA Output (RPM) Terminals**

This 3-position connector delivers an analog output signal proportional to the actual RPM speed.

**5**  **Relay Output (Creep) Terminals**

This 3-position connector gives access to the DMV-100 internal relay. The DMV-100 internal relay can be used by annunciation devices located on remote field equipment.

Note: Refer to the DMV-100 datasheet for load capacity.

**(6)** **Conditioner Input/Output Terminals**

The DMV-100 8-position removable connector receives the flying-lead end of the power and signal extension cable from the DCC-631 conditioner.

**(7)** **Fuse Receptacles (2)**

The system is equipped with dual in-line fuse protection in case of power overload. One fuse is provided for each lead to the power supply.

**(8)** **Power Input Terminals**

An internal power supply accepts AC or DC source. This power supply feeds the DMV-100 Unit and the DCC-631 Conditioner electronics.

**(9)** **Protective Conductor Terminal**

The protective conductor terminal on the rear panel must be connected to a grounding point in compliance with local regulations.

**(10)** **Green Power LED Indicator**

This green indicator turns on to confirm that the unit is powered.

## 5.2 Installation of the DMV-100 Unit in a 19" rack or cabinet

Although it is normally delivered as part of a complete system, already installed and pre-cabled in a new rack or cabinet, DMV-100 Units can also be ordered separately, as an addition to an existing installation.

### 5.2.1 Preliminary considerations for installation in a 19" rack or cabinet

The following guidelines will help you plan your equipment rack configuration:

- Allow sufficient clearance around the rack or cabinet for maintenance.
- The DMV-100 is designed for a 19" rack installation. A rack space of 2U (3.5") is required. Enclosed racks must have adequate ventilation, as each component generates heat. An enclosed rack should have enough ventilation and air circulation with help of fans and exhaust at adequate locations to keep enclosed rack pressurized and maintain temperature below 40°C.
- When mounting a unit in an enclosed rack, make sure that the unit's frame will not block the intake or exhaust ports.
- Baffles can help to isolate exhaust air from intake air, which also helps to draw cooling air through the unit. The best placement of the baffles depends on the airflow patterns in the rack.
- Cabling must be kept away from sources of electrical noise, power lines and fluorescent lighting fixtures. Keep signal cables apart from power cables.
- The unit must be kept away from sources of electrically conductive dust, as well as water or moisture.
- Heat generated by equipment near the bottom of the rack can be drawn upward into the intake ports of the equipment above. When mounted in an enclosed 19" rack or cabinet, it is suggested to leave at a space of at least 5 1/4" (3U) above each component for ventilation. Internal fans should also be installed between units to prevent stagnant air pockets.
- Side support angles are needed for the installation of the unit.
- A power source of 85-264$V_{AC}$ (47-63 Hz) or 105-370$V_{DC}$ must be supplied to the DMV-100 unit.
- The distance between the DCC-661 conditioner and the DMV-100 unit must not exceed the length of the power and output cable, which is 30 m (98 ft.).

### 5.2.2 Required tools and supplies

- wire cutters
- wire strippers
- assorted screwdrivers
- removable connector extractor (IC extracting tool)
- cable for main power input
- ground wire
- input/output signal cables
- mounting brackets to support the DMV-100 Unit
- cage nuts and screws

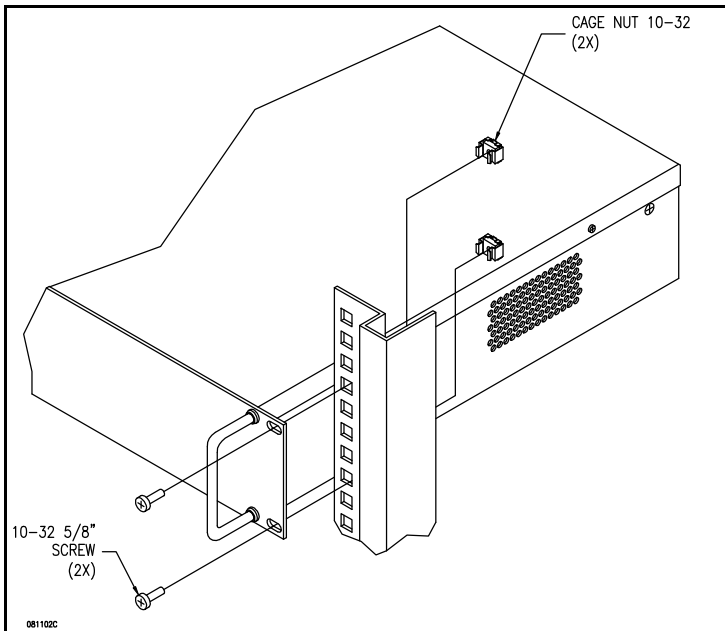### 5.2.3 Fixing the DVM-100 unit to the rack



1. Install the cage nuts onto the mounting rails.

2. Position the DMV-100 unit onto the mounting rails and secure it with the screws.

3. Additional support must be provided at the back of the unit, either by adding braces underneath the unit or installing support brackets (refer to next picture).

*Figure 30 : Securing the DMV-100 unit to the mounting rails*



 Additional support brackets are available in a variety of configurations. Shown here is an example of adjustable support bracket.

*Figure 31 : Additional support brackets*

## 5.3 Cabling the DMV-100 Unit
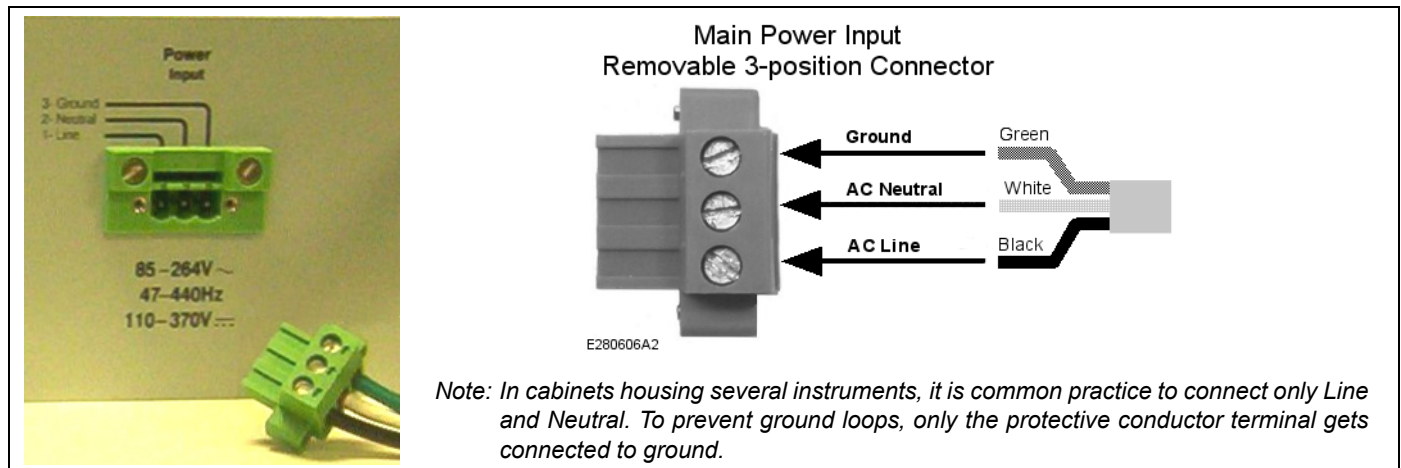
| ⚠ Warning - Danger      ⚠ Caution |
|---|
| • **The DMV-100 Unit power supply and grounding connection should be installed in accordance with national and local electrical code.**<br>• **To ensure protection, the chassis grounding wire must be of a heavier gauge than the grounding wire associated with the AC input.** |

### 5.3.1 Connecting the Power Input

The most common method of connecting the AC-input to the power supply connector is through the use of a three-wire electrical grounding-type cord (not supplied) fitting into a grounding-type power outlet, the socket outlet combination serving as the main disconnect device.

For safety purposes, a 15A circuit breaker should also be included in the AC-input wiring. Several instruments may be connected to a circuit protected by a circuit breaker. Each instrument must however have its own disconnect device.
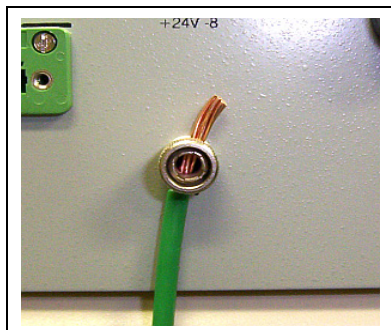


*Note: In cabinets housing several instruments, it is common practice to connect only Line and Neutral. To prevent ground loops, only the protective conductor terminal gets connected to ground.*

• Mechanical characteristics

Recommended wire size:  1,5 mm$^2$ *[16 AWG]* (600V rating)

### 5.3.2 Connecting the Protective Conductor Terminal



The protective conductor terminal must be connected to a grounding point in compliance with local regulations. Grounding is essential for safety purposes.

Mechanical characteristics

Wire size: at least 1,5 mm$^2$ *[16 AWG], up to* 6 mm$^2$ *[10 AWG]*

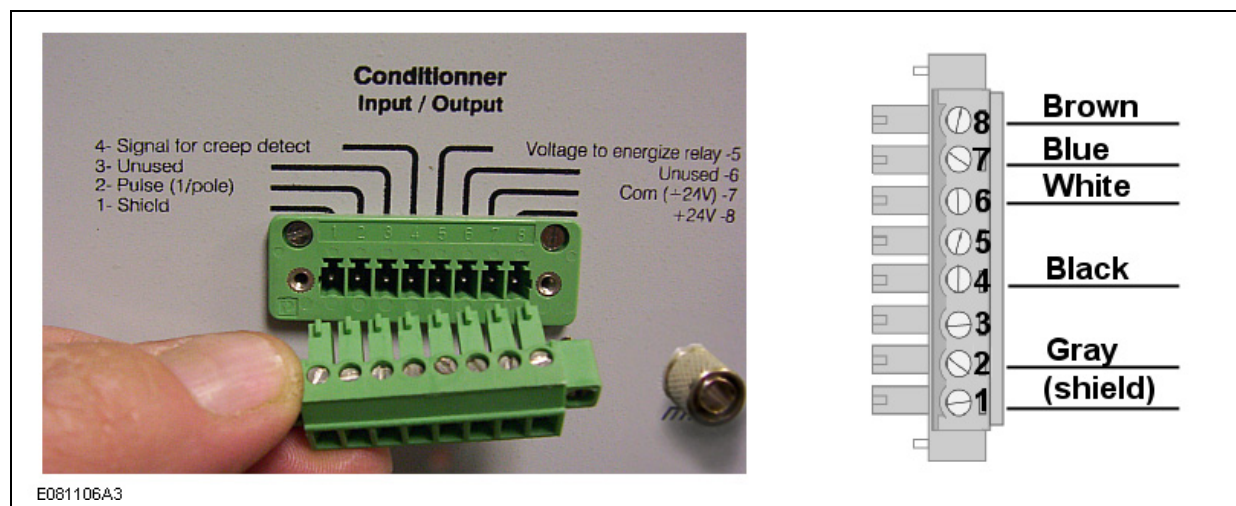### 5.3.3 Connecting the DCC-631 Conditioner to the DMV-100 Unit



*Figure 32 : Power input and signal output M12 connectorized cable connectors assignment*

This connector receives the flying-lead end of the extension cable running from the DCC-631 conditioner to the DMV-100 unit. Five conducting wires and shield must be connected as shown. The power and output cable sends creep detection signals and 1/pole pulses to the DMV-100 rack-mount unit, while the DMV-100 rack-mount unit uses one pair to send +24VDC power to the DCC-631 conditioner.

**Table 2: M12 connectorized cable to 8-position removable connector**

| Pin # | Standard M12 over-molded cable | Designation |
|-------|-------------------------------|-------------|
| 8 | Brown | +24 $V_{DC}$ to DCC-631 |
| 7 | Blue | Common to DCC-631 |
| 6 | White | (future use) |
| 4 | Black | Creep detection from DCC-631 (24VDC when machine stopped) |
| 2 | Gray | Pulse (1/pole) from DCC-631 |
| 1 | Shield | (ends at M12 connector plastic body) |

### 5.3.4 Connecting the Relay Output (Creep) Terminals

This is the three-terminal connector for the main DPDT power relay used for miscellaneous field equipment. As shown in *Figure 32 : "Power input and signal output M12 connectorized cable connectors assignment"*, the relay maintains NO and NC contacts, which alternate in the event of creep detection.
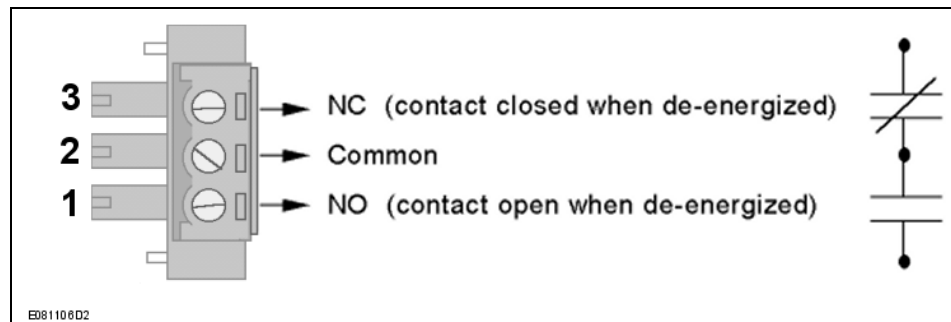


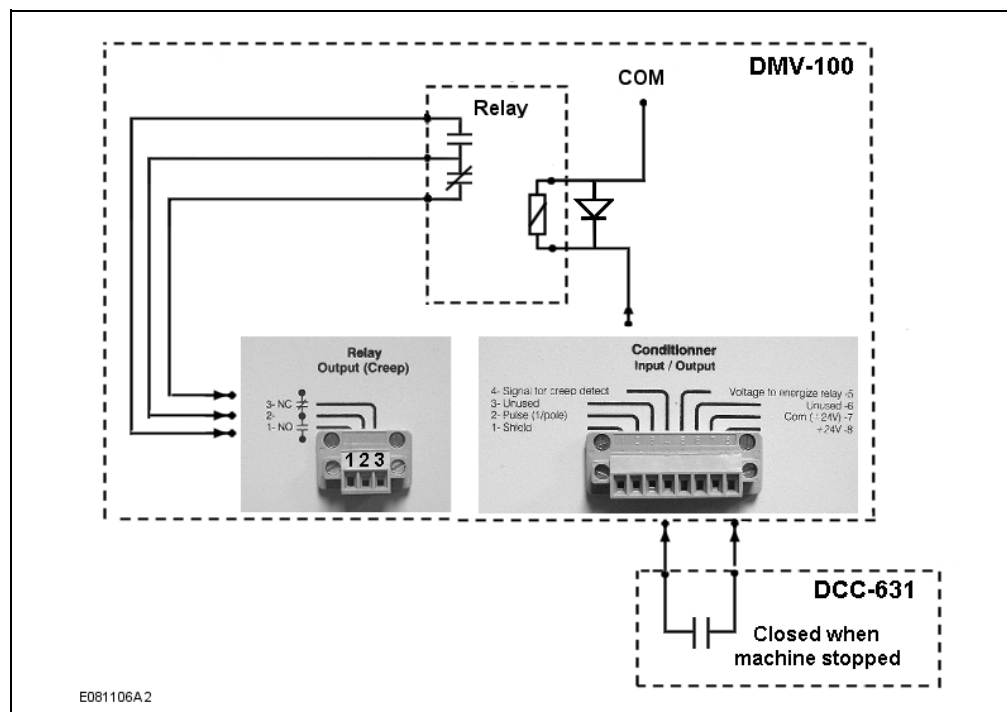*Figure 33 : Wiring assignment of the 3-position connector to Relay Output (Creep)*



*Figure 34 : Functional diagram of the DMV-100 internal relay*

The relay switches as follows:

**Table 3: Relay status according to event**

| Event Reported | Relay Status |
|---|---|
| Both LEDs inactive - main rack-mount unit powered-off | relay de-energized |
| Sensor and/or cable not connected | |
| Red "ROTATION" LED active - rotation reported | |
| Green "STOP" LED active - no rotation reported for more than 25 seconds | relay energized |

### 5.3.5  Connecting 4-20 mA Output (RPM) Terminals

This 3-position connector delivers an analog RPM signal, which corresponds to the displayed reading.
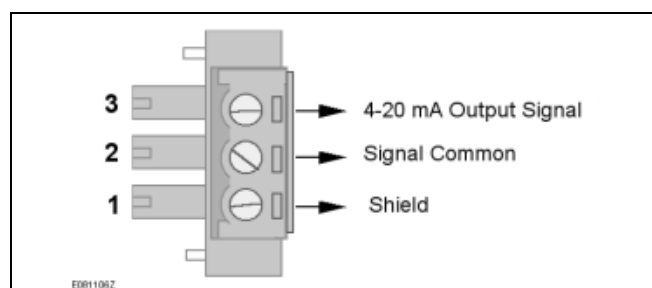


*Figure 35 : RPM output (4-20 mA) connector assignment*

> ⓘ **Note** :This output signal will drive a maximum resistive load of 500 $\Omega$.

To make use of this linear output, available to a controller or other third-party metering equipment, apply the following transfer formula:

$$RPM = \text{Linear Output (mA)} \times \frac{Max(RPM) - Min(RPM)}{16} + \frac{5\,Min(RPM)}{4} - \frac{Max(RPM)}{4}$$

where:
| | | |
|---|---|---|
| Min(RPM) | = | lower RPM limit as configured into the Speed Indicator |
| Max(RPM) | = | upper RPM limit as configured into the Speed Indicator |
| Linear Output (mA) | = | reading at 4-20 mA output terminals (see parameters **LSet.L** and **LSet.H** in Section *5.4.2.1 "Parameters"*) |

## 5.4  Initial setup of the DMV-100 System

### 5.4.1  Preliminary considerations

A minimum of setup may be required on the Speed Indicator before use. A setup is needed for correct display of RPM information based on the number of poles of the monitored machine. As well, to ensure accuracy, the indicator must be programmed to a specific RPM range.

#### 5.4.1.1   Pole detection functional aspect

For each passage of a pole, the conditioner transmits an impulsion (1/pole pulse) that is read by the speed indicator. The speed indicator measures the frequency of the impulsions and then converts it into RPM. Pole detection by the conditioner derives from hysteresis detection:

- minimum hysteresis is the proximity at which pole detection occurs
- maximum hysteresis is the maximal air gap value that can be associated with a pole and marks the end of pole detection

The conditioner transmits an impulsion as soon as the maximum hysteresis value is exceeded, and the measured air gap value must become lower than the minimum hysteresis value in order to validate the next maximum hysteresis value.
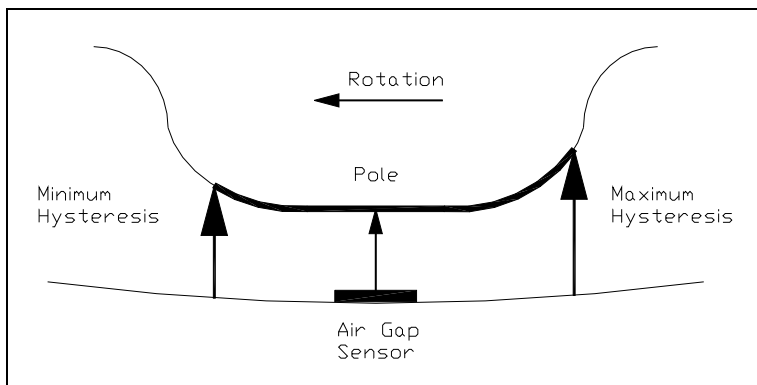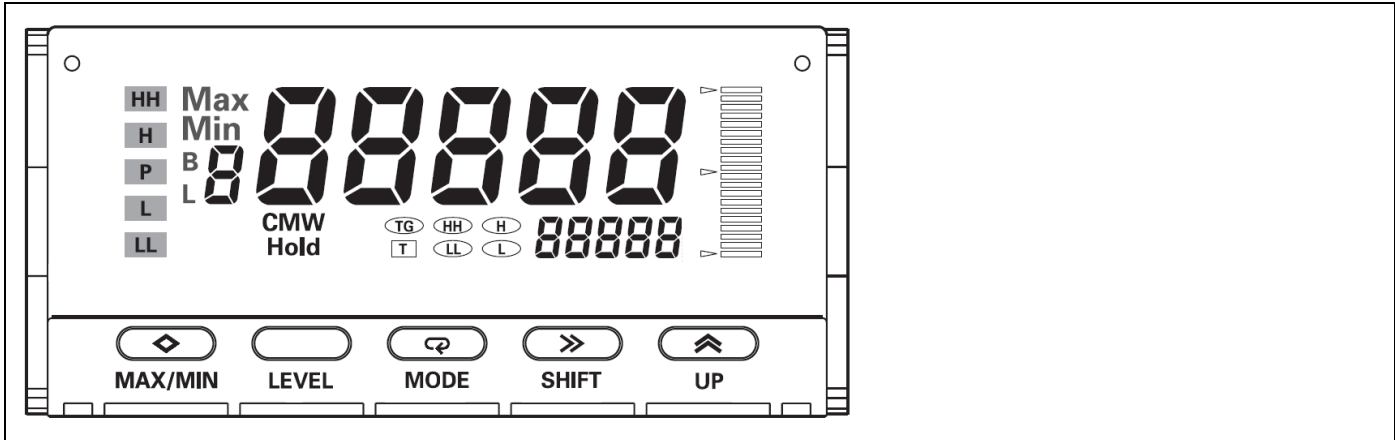
*Figure 36 : Hysteresis identification*

The minimum and maximum hysteresis values are factory preset to 46,6 mm and 45,3 mm.

### 5.4.2  Setup of the Speed Indicator



The Speed Indicator is in Running Mode as soon as the power is turned on. Proceed as follows to set up the speed indicator unit using the keypad located below the display.

- Press and hold the **LEVEL** key at least 3 seconds to access/exit configuration mode
- Press the **LEVEL** key to change level while in configuration mode
- Press the **MODE** key to display the next parameter within currently selected level
- Press the **SHIFT** key to edit currently displayed parameter
- Press the **UP** key to change the value of the currently displayed parameter

**Note:**  Although the Speed Indicator contains a larger set of parameters, only the setup of parameters used by the DMV-100 application is shown next.

### 5.4.2.1 Parameters

Parameters are grouped into different levels:

| Level | Parameter | Description | Possible values |
|-------|-----------|-------------|-----------------|
| L0 | FUNC | Function | **F1** (required value) |
| | IN-TA | Input type A | **00** (required value) |
| | PS.AX | Prescale AX (mantissa) | 0.0000 to 9.9999 |
| | PS.AY | Prescale AY (exponent) | -9 to 9 |
| | DP | Decimal point position | 0 to 4 (Precision from 0 to 4 decimals) |
| L1 | AVG-T | Average type | Simple average, moving average |
| | AVG-N | Averaging time | 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024 |
| | AT.ZA | Auto-zero time A | 0.0 to 2999.9 |
| | MEMO | Power interruption memory | OFF, ON |
| L2 | D.REF | Display refresh period | OFF, 0.5 s, 1 s, 2s, 4s |
| | DISP | Display value selection | PV, MAX, MIN |
| | RET | Automatic display return | 0 to 99 seconds |
| | POS-T | Position meter type | OFF, incremental, incremental (reversed) |
| | POS-H | Position meter upper limit | -19999 to 99999 |
| | POS-L | Position meter lower limit | -19999 to 99999 |
| L5 | LSET.C | Linear current model | 0 to 20mA, 4 to 20mA |
| | LSET.H | Linear output upper limit | -19999 to 99999 |
| | LSET.L | Linear output lower limit | -19999 to 99999 |

### 5.4.2.2 Prescale value

The speed indicator calculates the machine rotational speed (RPM) according to the following formula:

$$\textbf{Speed} = \text{freq. (Hz)} \times 60 \times \alpha$$

where: freq. (Hz) = poles per second (calculated on pulse signal input from DCC-631)
60 = constant value
$\alpha$ = 1 / number of poles on the monitored machine.

- The freq. (Hz) represents the number of pulses (1/pole) per second received from the DCC-631 conditioner
- The total number of pulses received per minute (freq. (Hz) x 60) has to be divided by the number of poles to obtain a speed in RPM. The $\alpha$ factor, called **prescale value**, is a fraction resulting from the division of 1 by the number of poles.

Example: An 80-pole rotor corresponds to a prescale value of $1{,}25 \times 10^{-2}$ ( $\alpha$ = 1 / 80)
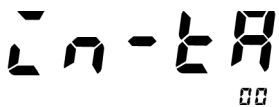
Note that during programming, the display uses scientific notation.

In this example, the following parameters will be set to the following values:

- Prescaling value X (mantissa): 1,25 (example value)
- Prescaling value Y (exponent): $10^{-2}$ (example value)
- Decimal point position: 0000.0 (example setting)
- Average type: set to simple average (suggested value)
- Average times: set to 16 for a 320 ms refresh period (suggested value)
- Auto-zero time A: set to 1.0 (example value)
- Power interruption memory: set to OFF (example value)
- Display refresh period: set to 0.5 (example value)
- Display value selection: set to PV (suggested value)
- Automatic Display return: set to 10 seconds (suggested value)
- Position meter type: set to incremental (suggested value)
- Position upper limit: set to 135 (example value)
- Position meter lower limit: set to 0 (example value)
- Linear current model: set to 4-20mA (required value)
- Linear output upper limit: set to 135 (example value)
- Linear output lower limit: set to 0 (example value)

### 5.4.2.3  Step by step setting procedure

Parameter setting is described below on the basis that the parameters are set for the first time. When entering a new configuration, it is important to follow this sequence. When making changes to an existing configuration, you may go directly to the area of concern.

| | Action / Comments | Display |
|---|---|---|
| 1 | Press and hold the **Level** key to enter editing mode.<br>The first set of parameters (*Initial setting*) will be presented | |
| | **Initial setting** | $\boxed{L\,0}$  = set of parameters at Level 0 |
| 2 | <u>FUNC: Function</u><br>Do not change the setting: the DMV-100 application uses only the **F1** function<br>* For reference only, results are displayed as:<br>    **F1 = RPM / Circumferential speed**<br>    F2 = Absolute ratio (unit: %)<br>    F3 = Error ratio (unit: %)<br>    F4 = Error (unit: %)<br>    F5 = Concentration (unit: %)<br>    F6 = Passing time (unit: s (input pulse cycle))<br>Press the **Mode** key for next parameter. | *FUnC*<br>*F1* |
| 3 | <u>IN-TA: Input type A</u><br>Do not change the setting: the DMV-100 application uses only the **00** no contact (NO) input type<br><br>Press the **Mode** key for next parameter. | *In-tA*<br>*00* |
| 4 | <u>PS.AX: Prescale AX</u> (mantissa)<br>(0.0000 to 9.9999)<br><br>Press the **Shift** key to edit the parameter and use **Up** key to select 1.2500 (example value for an 80-pole rotor with a prescale of 0.0125)<br>Press the **Mode** key for next parameter. | *PS.AX*<br>*1.2500* |
| 5 | <u>PS.AY: Prescale AY</u> (exponent)<br>(0 to 4)<br><br>Press the **Shift** key to edit the parameter and use **Up** key to select **- 2** (example value for an 80-pole rotor with a prescale of 0.0125)<br>Press the **Mode** key for next parameter. | *PS.AY*<br>*10  -2* |
| 6 | <u>DP: Decimal point position</u><br>(0 to 4)<br><br>Press the **Shift** key to edit the parameter, use **Up** key to move the decimal point.<br>Press the **Level** key to access the *Input adjustment level* parameters. | *dP*<br>*0000.0* |
| | **Input adjustment** | $\boxed{L\,1}$  = set of parameters at Level 1 |

| | | |
|---|---|---|
| **7** | <u>AVG-T: Average type</u><br>(Simple average / Moving Average)<br><br>Press the **Shift** key to edit the parameter and use **Up** key to select **Simple** average.<br>Press the **Mode** key for next parameter. | $AuG$-$t$<br><br>5ñPL |
| **8** | <u>AVG-N: Averaging times</u><br>(1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024 times)<br><br>Press the **Shift** key to edit the parameter and use **Up** key to select **16**.<br>(16 = 320 ms refresh period)<br>Press the **Mode** key for next parameter. | $AuG$-$n$<br><br>16 |
| **9** | <u>AT.ZA: Auto-zero time A</u><br>(0.0 to 2999.9)<br><br>Press the **Shift** key to edit the parameter and use **Up** key to select **1**.<br>Press the **Mode** key for next parameter. | At.ZA<br><br>1.0 |
| **10** | <u>MEMO: Power interruption memory</u><br>(OFF, ON)<br><br>Press the **Shift** key to edit the parameter and use **Up** key to select **OFF**.<br>Press the **Level** key to access the *Display adjustment* parameters. | ñEñō<br><br>ōFF |
| | **Display adjustment** | $\boxed{L\ 2}$  = set of parameters at Level 2 |
| **11** | <u>D.REF: Display refresh period</u><br>(OFF, 0.5 s, 1s, 2s, 4s)<br><br>Press the **Shift** key to edit the parameter and use **Up** key to select **0.5** s.<br>Press the **Mode** key for next parameter. | d.rEF<br><br>0.5 |
| **12** | <u>DISP: Display value selection</u><br>(PV, MAX, MIN)<br><br>Press the **Shift** key to edit the parameter and use **Up** key to select **PV**.<br>Press the **Mode** key for next parameter. | dīSP<br><br>Pu |
| **13** | <u>RET: Automatic display return</u><br>(0 to 99 s)<br><br>Press the **Shift** key to edit the parameter and use the **Up** key to set the value to **10** s.<br>Press the **Mode** key for next parameter. | rEt<br><br>10 |
| **14** | <u>POS-T: Position meter type</u><br>(OFF, incremental, incremental (reversed))<br><br>Press the **Shift** key to edit the parameter and use the **Up** key to select **inc**remental.<br>Press the **Mode** key for next parameter. | PōS-t<br><br>īnC |

| 15 | POS-H: Position meter upper limit <br>(-19999 to 99999) <br><br>Press the **Shift** key to edit the parameter and use **Up** key to select **135**. <br>Press the **Mode** key for next parameter. | *PoS-H* <br>135 |
|---|---|---|
| 16 | POS-L: Position meter lower limit <br>(-19999 to 99999) <br><br>Press the **Shift** key to edit the parameter and use **Up** key to select **0**. <br>Press the **Level** key to access the *Linear output level* set of parameters. | *PoS-L* <br>0 |
| | **Linear output** | ⌊5⌋ **= set of parameters at Level 5** |
| 17 | LSET.C: Linear current model <br>(0 to 20 mA or 4 to 20 mA) <br><br>Press the **Shift** key to edit the parameter and use the **Up** key to select **4-20** mA. <br>Press the **Mode** key for next parameter. | *LSEt.C* <br>4-20 |
| 18 | LSET.H: Linear output upper limit <br>(-19999 to 99999) <br><br>Press the **Shift** key to edit the parameter and use **Up** key to select **135**. <br>Press the **Mode** key for next parameter. | *LSEt.H* <br>135 |
| 19 | LSET.L: Linear output lower limit <br>(-19999 to 99999) <br><br>Press the **Shift** key to edit the parameter and use **Up** key to select **0**. <br>Press the **Level** key to access the *Output test* level. | *LSEt.L* <br>0 |
| 20 | This concludes the configuration. <br><br>Press and hold the **Level** key at least 3 seconds to return to the Monitor mode. | |

### 5.4.2.4   Additional information on parameters

## INITIAL SETTING PARAMETERS

- **Function**

  Six types of function are available to specify how speed and other calculations will be performed. In the DMV-100 application, function **F1** is needed. For reference only, the functions are:

  - F1 (RPM/circumferential speed): displays rotation (RPM) or circumferential speed for one input
  - F2 (Absolute ratio): displays calculation result for two rotation (RPM) speeds
  - F3 (Error ratio): displays calculation result for two rotation (RPM) speeds
  - F4 (Rotational difference): displays calculation result for two rotation (RPM) speeds
  - F5 (Flow rate ratio): displays calculation result for two rotation (RPM) speeds
  - F6 (Passing time): displays the passing time calculated from the circumferential speed and the length of the processing stage for one input

- **Input type**

  Four types of input signals can be specified. In the DMV-100 application, type **00** is required. For reference only, the input types are:

  - No-voltage contact (30-Hz max. with ON/OFF pulse width of 15 ms min.);

  - Voltage pulse (50-kHz max. with ON/OFF pulse width of 9 $\mu$s min.; ON voltage: 4.5 to 30V; OFF voltage: -30 to -2 V; input impedance: 10 k$\Omega$)

  - Open collector (50-kHz max. with ON/OFF pulse width of 9 $\mu$s min.)

|  | NO: Voltage pulse high | NC: Voltage pulse low |
|---|---|---|
| No-contact or voltage pulse input | 00 | 01 |
| Contact | 10 | 11 |

- **Prescaling value X (mantissa)**
- **Prescaling value Y (exponent)**

  To make calculations using the input pulse to display rotation (RPM), the number of pulses per rotation must be converted into a coefficient, called the $\alpha$ prescale value. In the DMV-100 application, the number of pulses per rotation corresponds to the number of poles on the rotor.

  **Rotation speed (RPM) = f x 60 X $\alpha$**

  > f:   Input pulse frequency (No. of pulses per second)
  > $\alpha$:   Prescale value

  Ex.: If there are 80 poles on the rotor, then:

  $\alpha$ = 1/80 (=0.0125)

  Prescaling value X (mantissa) = 1.25

  Prescaling value Y (exponent) = $10^{-2}$

- **Decimal point position**: The decimal point position for scaling values depends on the decimal point position setting. Up to four digits below the decimal point can be displayed.

## INPUT ADJUSTMENT PARAMETERS

- **Average type**: average processing of input values smooths the displays and outputs for inputs with extreme fluctuations, such as spike noise. There are two types of averaging: "simple" and "moving".

  - Simple averaging is used when the display refresh period is to be lengthened.

  - Moving averaging is used to remove periodic noise superimposed on input signals.

- **Average times**: The data refresh periods when averaging is used are given in the following table
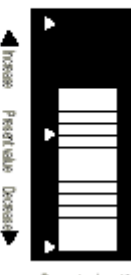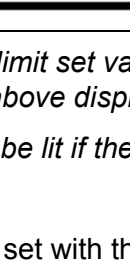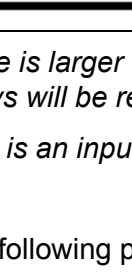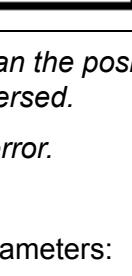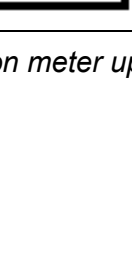
|  | Set value | Refresh period |
|---|---|---|
| No averaging | 1 | Every 20 ms |
| Simple average | 2 | Every 40 ms |
|  | 4 | Every 80 ms |
|  | 8 | Every 160 ms |
|  | 16 | Every 320 ms |
|  | 32 | Every 640 ms |
|  | 64 | Every 1.28 s |
|  | 128 | Every 2.56 s |
|  | 256 | Every 5.12 s |
|  | 512 | Every 10.24 s |
|  | 1024 | Every 20.48 s |
| Moving average | 1 to 1024 | Every 20 ms |

- **Auto-zero time A**: The frequency can be force-set to zero if there is no input pulse for a set period. The display will not easily return to zero if the auto-zero time is too long or left at the default setting.

  Due to the principle of forecasted cycle calculation, the frequency will not become zero even if the input signal is cut off. The time from cutoff of the input pulse to the zeroing of the measurement frequency is called the auto-zero time. A value from 0.0 to 2999.9 can be specified.

- **Power interruption memory**: The measured value can be recorded when the power supply is interrupted. This function is not used by the DMV-100 system and can be set to OFF.

## DISPLAY ADJUSTMENT PARAMETERS

Enable/disable comparative set value displays, and set the display refresh periods and position meter.

- **Display refresh period**: set to 0.5 (example value)

  When the input changes rapidly, the display refresh period can be lengthened to control flickering and make the display easier to read.

- **Display value selection**: set to **PV**

  The display value can be set to the present value, the maximum value, or the minimum value.

- **Automatic Display return**: set to **10** seconds (suggested value)

  The display automatically returns to RUN level when there are no key operations during setting operations. The length can be adjusted here.

- **Position meter type**: set to incremental (recommended setting)

  The meter on the right side of the front panel contains 20 sections to show the position of the displayed RPM value in relation to set upper and lower RPM limits. The display pattern can be set as follows:



**Note**: *If the position meter lower limit set value is larger than the position meter upper limit set value, the top and bottom of the above displays will be reversed.*

*The position meter will not be lit if there is an input error.*

The upper and lower limits can be set with the following parameters:

- **Position upper limit**: set to 135 (example value)
  Set maximum RPM for the scale.

- **Position meter lower limit**: set to 0 (example value)
  Set minimum RPM for the scale

## LINEAR OUTPUT PARAMETERS

The Speed Indicator linear offers an output current proportional to RPM measurement values as they change.

Select the type of linear output with the following parameter:

- **Linear current model**: **4-20** mA (required setting)

Set the corresponding RPM range proportional to the current output through the following parameters:

- **Linear output upper limit**: 135 (example value)
- **Linear output lower limit**: 0 (example value)

## Environmental

- Temperature:
  - Operation                 0° to 50° C          *[32° to 122° F]*
  - Storage                    -20° to 65° C        *[- 5° to 150° F]*
- Humidity                      Up to 90%, non-condensing

## Physical characteristics

- Casing                        2U, 19" rack-mount
- Dimensions
  - Height                     8.9 cm                *[3.5 in.]*
  - Width                      48.3 cm               *[19.0 in.]*
  - Depth                      30.5 cm               *[12.0 in.]*
  - Weight                     7.25 kg               *[16 lb]*