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Operating instructions

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ecomat200

Monitor FR-2

DD2002

DD2005

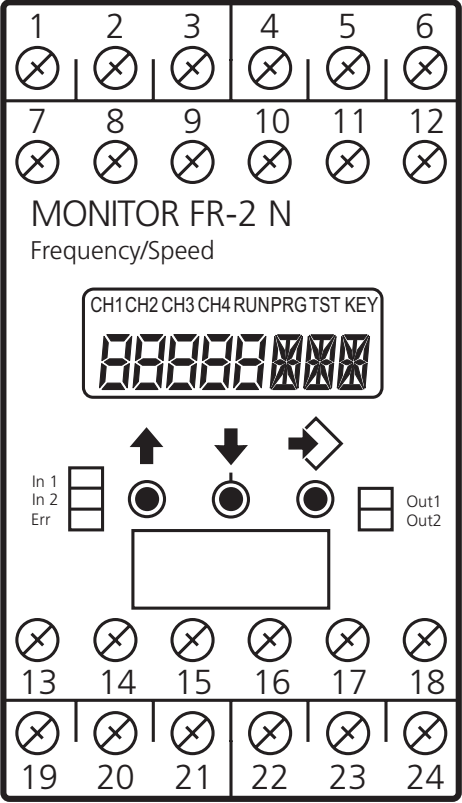
DD2006

Monitor FR-2 N

DD2105

DD2106

7390340 / 01 07 / 2008



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1 The operating instructions

... apply to all control monitors of type FR-2 / FR-2 N with switched-mode power supply or transformer power supply. The only difference between the individual units is the height of the permissible AC or AC / DC power supply which is indicated on the type label of the unit.

... are part of the unit. They contain information about the correct handling of the product. Read them before use to get familiar with operating conditions, mounting and operation. Adhere to the safety instructions. The operating instructions are made for authorised persons according to the EMC and low voltage guidelines.

2 Safety instructions

Follow the operating instructions. Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or handling can affect the safety of people and the plant.

The installation and connection must comply with the applicable national and international standards. Responsibility lies with the person installing the unit.

The unit must be installed, connected and put into operation by a qualified electrician as

- during the installation dangerous contact voltage occurs and
- the safe function of the unit and the plant is only guaranteed when installation is correctly carried out.

Disconnect the unit externally before handling it. Also disconnect any independently supplied relay load circuits.

Be careful when handling the connected unit. Due to the protection rating IP 20 this is only allowed by qualified personnel.

The design of the units corresponds to the protection class II except for the terminal blocks. Protection against accidental contact (finger-touch to IP 20) for qualified personnel is only guaranteed if the terminal screw has been completely screwed in. For the correct operation the unit must be mounted in a housing (protection rating IP 40 or higher) which can only be opened using a tool or in a closed control cabinet.

If the unit has an external 24 V DC supply, this voltage must be generated and supplied externally according to the requirements for safe extra-low voltage (SELV) since without further measures this voltage is supplied near the operating elements and at the terminals for the supply of connected pulse pick-ups.

The wiring of all signals concerning the SELV circuit of the unit must also meet the SELV criteria (safe extra-low voltage, safe electrical separation from other circuits).

If the externally supplied or internally generated SELV voltage is externally grounded, the responsibility lies with the user in accordance with the applicable national installation regulations. All statements in the operating instructions refer to the unit which is not grounded with respect to the SELV voltage.

It is not allowed to supply external voltage to the terminals for the pulse pick-up supply. The consumption of current which exceeds the value given in the technical data is not allowed.

An external main switch must be installed for the unit which can switch off the unit all related circuits. This main switch must be clearly assigned to the unit.

According to the technical specifications below the unit can be operated in a wide operating temperature range. Because of the additional internal heating the operating elements and the housing walls can have high perceptible temperatures when touched in hot environments.

In case of malfunction of the unit or uncertainties please contact the manufacturer. Tampering with the unit can seriously affect the safety of people and the plant. This is not permitted and leads to an exclusion of liability and warranty.

3 Function and features

The monitor FR-2 / FR-2 N is a double pulse evaluation system. It separately monitors two different linear, pendular, pulsating and rotating movements. To do so, the monitor receives pulses from external pulse pick-ups on 2 separate input channels, calculates the corresponding input frequency (= actual value) from the period duration, compares it with the preset switch point (preset value) of the corresponding channel and switches the corresponding output according to the set parameters.

The display shows the current input frequency on channel 1 or channel 2.

The unit functions can be adapted to the respective application by setting various parameters.

Pulse pick-ups for the monitor FR-2

3-wire DC (PNP or NPN), 2-wire AC / DC, 2-wire quadrorm, NAMUR pulse pick-ups up to 25 V DC

Pulse pick-ups for the monitor FR-2 N

Only NAMUR pulse pick-ups according to EN 50227 (8.2 V DC)

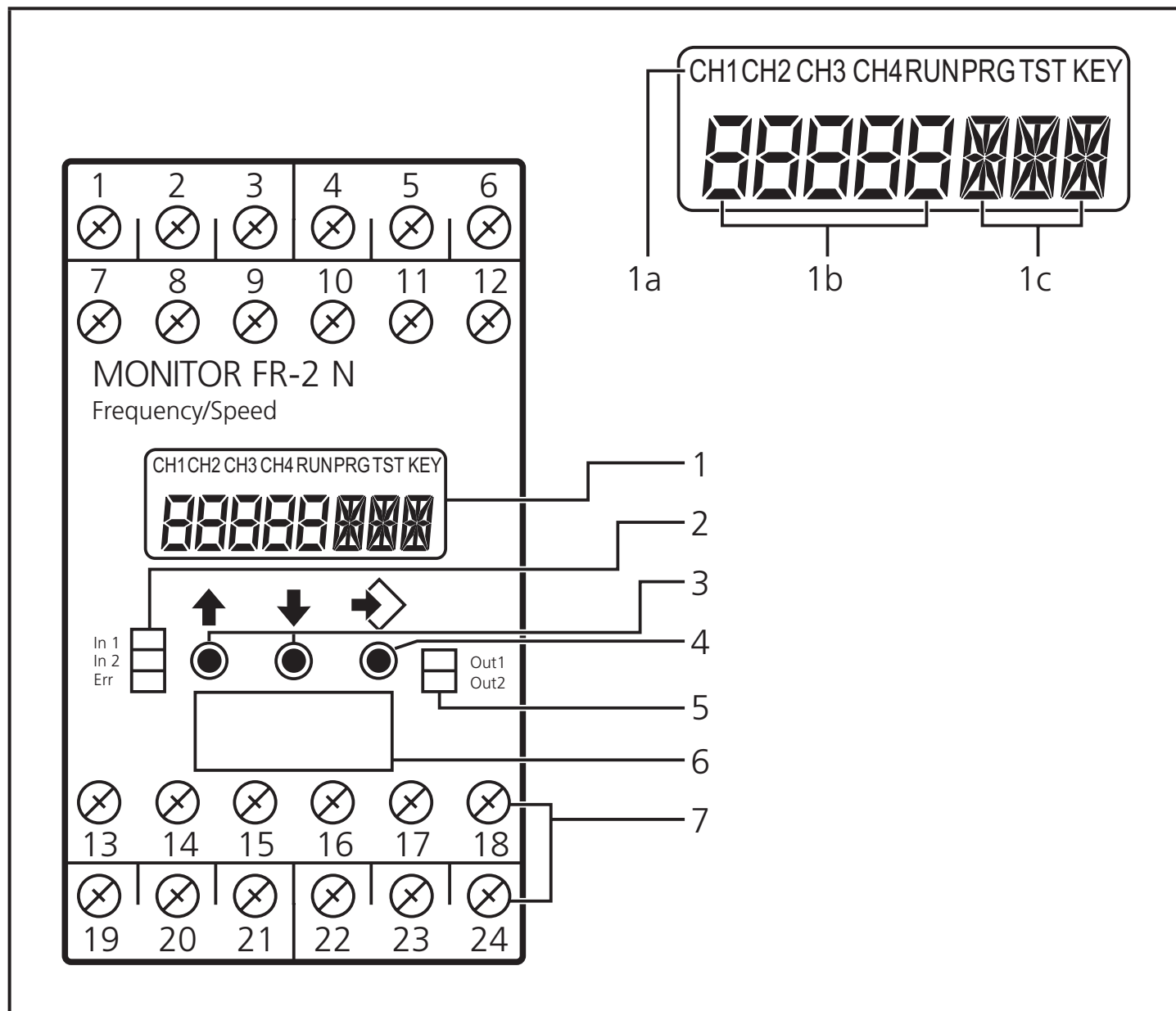
The monitor FR-2 N provides the additional function wire monitoring (wire faults are signalled by LED and transistor outputs).



FR-2 monitors and FR-2 N monitors are not approved for safety tasks in the field of safety of persons.

4 Unit description

4.1 Operating and indicating elements



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| | | | |
|---|-----------------------------|----|--|
| 1 | Display (7 / 14 segment) | 1a | Indicators: CH1...CH4 = indicators for input channels (here: CH1 and CH2) RUN = indicator for the normal operating mode PRG = indicator for the programming mode TST = indicator for the test function KEY = indicator for the unit status (locking) |
| | | 1b | Numerical display for actual values and the parameter values (5 digits) |
| | | 1c | Alphanumeric display for parameter abbreviation and units (3 digits) |

| | |
|----------|--|
| 2 | LEDs In 1 and In 2 (yellow): signal input pulses Only for FR-2 N: LED Err (red): comes on if there is a fault of the pulse pick-up cable (at the same time the LED of the faulty input flashes) |
| 3 | Setting buttons: selection of parameters, setting of parameter values, selection of the actual value display |
| 4 | Programming button: selection of the operating mode, storage of the parameter value, front reset |
| 5 | LEDs: signal the output state |
| 6 | Panel for labelling |

5 Operating modes

The unit has the following operating modes:

Run mode (normal operating mode), Display mode (display of parameters and preset parameter values), Programming mode (setting of parameter values). In addition a test function can be activated (all settings and functions can be tested in a simulated operation outside the real plant).

5.1 Run mode

When the supply voltage has been applied (or when no push-button is pressed for approx. 15 s) the unit is in the Run mode.

The RUN indicator is indicated in the display and the unit starts monitoring on the basis of the preset parameters and switches relay and transistor outputs accordingly.

The alphanumeric display shows the last selected measured value of the input channel 1 or input channel 2 together with the unit programmed (e.g. "48 RPM"). You can alternate between these two values by pressing the push-buttons \uparrow or \downarrow . The active channel is indicated by the channel indicator CH1 (or CH2).

The actual values are indicated in the ranges 0.1...1000.0 Hz or 0...60000 RPM. The monitor can display either Hz or RPM depending on the parameters that have been set.

5.2 Display refresh

An average of the last ten measurements is displayed (once every second) so that the displayed actual values can be read. This has no effect on the response time of the monitor, in any case each pulse is evaluated.

LEDs IN1 and IN2: input signal status


The LED Err (only for FR-2 N) comes on if there is a fault of the pulse pick-up cable (wire break, short circuit).

LEDs Out1 and Out2 signal the switching state of the outputs:

- LED off = the respective output is not switched (relay de-energised, transistor blocked).
- LED on = the respective output is switched (relay energised, transistor switched).
- LED quickly flashing = the latched output function is active for the respective output (see below: adjustable parameters, SO1 / SO2).


- LED slowly flashing = the delay time is active for the respective output. It switches when the delay time has elapsed and overspeed or underspeed remains (see below: adjustable parameters, DT1 / DT2).



5.3 Display mode

By pressing the  push-button briefly the unit changes from the Run mode to the Display mode. Internally the unit remains in the operating mode (thus the indicator "RUN" remains in the display). Irrespective of this, all parameters as well as the set parameter values can be indicated without changing them.


First of all select the parameter range. The unit has 2 parameter ranges, the number of the selected range is displayed by stepping through the parameters



When the unit has passed to the Display mode, the indicator is in the parameter range 1, by pressing the  push-button briefly you get to the parameter range 2.


Within the parameter range the next / preceding parameter can be selected by pressing the  or  push-buttons. It is displayed by the parameter abbreviation in the 3-digit alphanumeric display. The current (preset) parameter value is displayed in the 5-digit numerical display.

Example:  = 1000 RPM for switch point 1 (Switch Point Out1).




Terminate the Display mode and return to the Run mode by pressing the  push-button for approx. 3 s. When no push-button is pressed for approx. 15 s (timeout), the unit automatically returns to the Run mode.

5.4 Programming mode

Select the programming mode by

- changing to the Display mode first,
- then selecting the parameter you would like to change
- and then by pressing the  push-button briefly.s

Internally the unit also remains in the operating mode. This means that it continues its monitoring function with the existing parameters until the change has been stored. In the display the RUN indicator is indicated next to the PRG indicator. In addition the parameter abbreviation is flashing in the 3-digit alphanumeric display.


You can now change the parameter value within the permissible range of values by the push-buttons  or . The set parameters are stored by pressing the  push-button until the PRG indicator no longer flashes. As soon as the PRG indicator

is no longer displayed, you can release the push-button. The new value is permanently stored and effective immediately.

Then the unit returns to the Display mode and displays the current parameter value which has just been changed by the parameter abbreviation in the 3-digit alphanumeric display.


You can now

- select another parameter and change it or
- exit the Display mode.



When all the parameters have been set and confirmed, return to the Run mode by pressing the  push-button for approx. 3 s.

When no push-button has been pressed for approx. 15 s, the unit automatically returns to the Run mode.


5.4.1 Cancel the parameter setting

If you press the  push-button only briefly when the parameter value has been changed, or if no push-button is pressed for approx. 15 s, the unit will default back to its previous settings. The unit returns to the Display mode and indicates the old parameter value which remains effective.

5.4.2 Locking / Unlocking

The unit can be locked so that unintentional incorrect entries can be avoided: Press the push-buttons  and  simultaneously and hold them. The "KEY" indicator is flashing.

Release the push-buttons when the indicator is constantly lit in the display.

For unlocking press the push-buttons  and  simultaneously and hold them. The "KEY" indicator is flashing

Release the push-buttons when the indicator is no longer displayed.

5.4.3 Test function

Via this simulation function correct operation of how you have set the units (switching functions) can be checked before connection to the plant.

Special function wire monitoring (only for FR-2 N)

The monitor FR-2 N continuously monitors the pulse pick-up cable. In case of a wire break or short circuit transistor outputs (terminal 4 for In1 and terminal 10 for In2) signal the fault, the LED Err comes on.

With the parameter FWx you can influence the output behaviour in case of a fault.

6 Adjustable parameters

The functions of the unit can be adapted to the respective application by the setting of various parameters. The following parameters can be set:

- general parameters (display format, number of cams),
- parameters for the switching function and for the switch points,
- time functions,
- special functions (latched output function).

6.1 General parameters

6.1.1 DIM

Dimension (display format)

The measured frequency and all corresponding switch points can be displayed and set either in Hz (Hertz) or RPM (revolutions per minute). This setting applies to all channels.

For each measured value or switch point you can see whether RPM or Hz is active: RPM is displayed as 5-digit number without decimal point, Hz as 4-digit number with one decimal place after the point.

When you change the unit later on, the monitor converts all existing values into new values. Set the desired unit first and then enter the other parameters.

- Range of values: 0 and 1 (0 = RPM, 1 = Hz).
- Presetting in the factory: 0 (= display in RPM).

6.1.2 NCx

Number of Cams for input channel x:

For speed monitoring the number of cams to be detected per revolution can be set. The monitor calculates the correct number of revolutions on the basis of this value (measured frequency / NC = displayed frequency). The unit is RPM.

For real frequency measurements NC = 1 should be selected.

- Range of values: 1...999.
- Presetting in the factory: 1.

6.2 Switching functions and switch points

6.2.1 FOx

Function Output for Out x (switching function for output x):

You can select one of the 6 functions for each of the two outputs:

1. Relay energises (transistor output conductive) when the actual value is below the switch point (machine indication is "minimum speed" / "standstill").
 2. Relay de-energises (transistor output non-conductive) when the actual value is below the switch point (error message "underspeed" / "blocked").
 3. Relay energises (transistor output conductive) when the actual value is above the switch point (machine indication is "speed reached").
 4. Relay de-energises (transistor output non-conductive) when the actual value is above the switch point (error message "overspeed").
 5. Relay is energised (transistor output conductive) within a frequency range (acceptable range).
 6. Relay is de-energised (transistor output non-conductive) within a frequency range.
- Range of values: 1...6.
 - Presetting in the factory: FO1 = 2, FO2 = 3.

For functions 5 and 6 you define a tolerance range above and below the switch point (SP) by setting the hysteresis (HY) which has a different meaning for the switching functions 5 and 6 than for the switching functions 1 to 4.

$$SP = \frac{\max + \min}{2}$$

$$HY = \frac{SP - \min}{SP} \times 100 [\%]$$

6.2.2 SPx

Switch Point for output x:

Set value where the respective output changes its switching state.

Set the DIM parameter to the desired value first.

SP1 applies to output 1, SP2 to output 2; both values are independent of each other.

- Range of values: 0.1...1000.0 Hz or 1...60000 RPM (depending on the set DIM).
- Presetting in the factory: 100 RPM for output 1, 1000 RPM for output 2.

6.2.3 HYx

Hysteresis for output x:

To avoid output chattering near the switch point, each switch point can have its own hysteresis value (distance between switch-on point and switch-off point). The hysteresis is given in % of the switch point and the unit uses it according to the selected switching function.

Set the DIM and Spx parameters to the desired value before setting the hysteresis.

HY1 applies to output 1, HY2 to output 2; both values are independent of each other.

- Range of values: 0.1...1000.0 % of the value for SP.
- Presetting in the factory: 5.0.

6.3 Time functions

6.3.1 STx

Start-up delay for output x:

When the unit has been switched on (Power ON) or when the 24 V signal has been removed from the corresponding RESET input, the respective output remains in the "no failure" state during this time irrespective of the real values measured.

The start-up delay is mainly used to suppress the failure message in the switching function FO2 (error message "underspeed") since every time the plant is started the motors have to run up to speed first.

- Range of values: 0.0...1000.0 s.
- Presetting in the factory: 0.0 (start-up delay is not active).

6.3.2 DTx

Delay time for output x:

This delay time prevents the respective output from changing its switching state immediately when overspeed or underspeed has occurred. The output only switches if overspeed or underspeed still prevails after the delay time. If this is not the case when DT has elapsed, the delay time is reset and the output remains in the non-switched state. The delay time only applies to the switching of the output (relay energised, transistor switched), not for resetting the output.

If DT is active, the corresponding LED Out flashes slowly ($\gg 1$ Hz).

DT1 applies to output 1, DT2 to output 2.

- Range of values: 0.0...1000.0 s.
- Presetting in the factory: 0.0 (delay time is not active).

6.3.3 FTx

Fleeting time for output x:

This parameter is a time function and activates the FT function:

- When $FT = 0$, the function is not active.
- When $FT > 0$: the output changes its switching state when the switching signal occurs during the set fleeting time (whether the switching signal is still present or not). When the fleeting time has elapsed, it returns to the initial state.
It does not make sense to activate FT and the latched output function (SO) for

the same output.

FT1 applies to output 1, FT2 to output 2.

- Range of values: 0.0...1000.0 s.
- Presetting in the factory: 0.0 (fleeting time not active).


6.4 Special functions

6.4.1 SOx

Store Output for Out x (latched output function for output x):

This is an extended operating mode, preferably in conjunction with the switching functions 1 and 4 or 2 and 3. The output changes its switching state when the switch point is reached but (unlike the normal operating modes) this switching state remains (= latched) irrespective of the current input frequency at that time. This state is indicated by the fast flashing of the Out LED of the respective output (» 2.5 Hz).

The latched output has to be reset by

- manual reset (= pressing the  push-button for at least 3 seconds),
- a 24 V DC pulse at the corresponding reset input or
- by interrupting the operating voltage.

NOTE: Reset is only possible when the monitor is in the RUN mode (display of the actual value). If "overspeed / underspeed" remains after the reset, the latched output function becomes active again.

SO1 applies to output 1, SO2 to output 2.

- Range of values: 0, 1, 2:
 - 0 = latched output function not active
 - 1 = latched output function only with front reset
 - 2 = latched output function with front reset and external reset

Please consider: When the function start-up delay (ST) is activated, the set start-up delay starts after the external reset.

- Presetting in the factory: 0 (latched output function is not active).

6.4.2 FWx (only for FR-2 N)

Function Wire Monitoring for Out x:

Influences the switching behaviour of the corresponding output in case of a fault (input frequency = 0):

| | | |
|---------------------------------------|------------------------------|----------------------------|
| A) frequency > switch point | FW = 0 (function not active) | FW = 1 (function active) |
| switching functions 1 and 4 | relay energised | relay remains de-energised |
| switching functions 2 and 3 | relay de-energised | relay de-energised |
| B) frequency < switch point | FW = 0 (function not active) | FW = 1 (function active) |
| switching functions 1 and 4 | relay remains energised | relay de-energised |
| switching functions 2 and 3 | relay de-energised | relay remains de-energised |
| C) frequency within the window | FW = 0 (function not active) | FW = 1 (function active) |
| switching function 5 | relay de-energised | relay de-energised |
| switching function 6 | relay energised | relay de-energised |

Relay energised = transistor output conductive, relay de-energised = transistor output blocked.

- Range of values: 0.1;
- Presetting in the factory: 0.

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6.5 Parameter table / Navigating

The adjustable parameters are stored in the unit in the form of a table. Column 1 contains the parameters for output 1, column 2 the parameters for output 2. Column 0 contains the current measured values displayed in the RUN mode. The number behind the parameter abbreviation (e.g. SP1 or SP2) shows you which column is active at the moment.

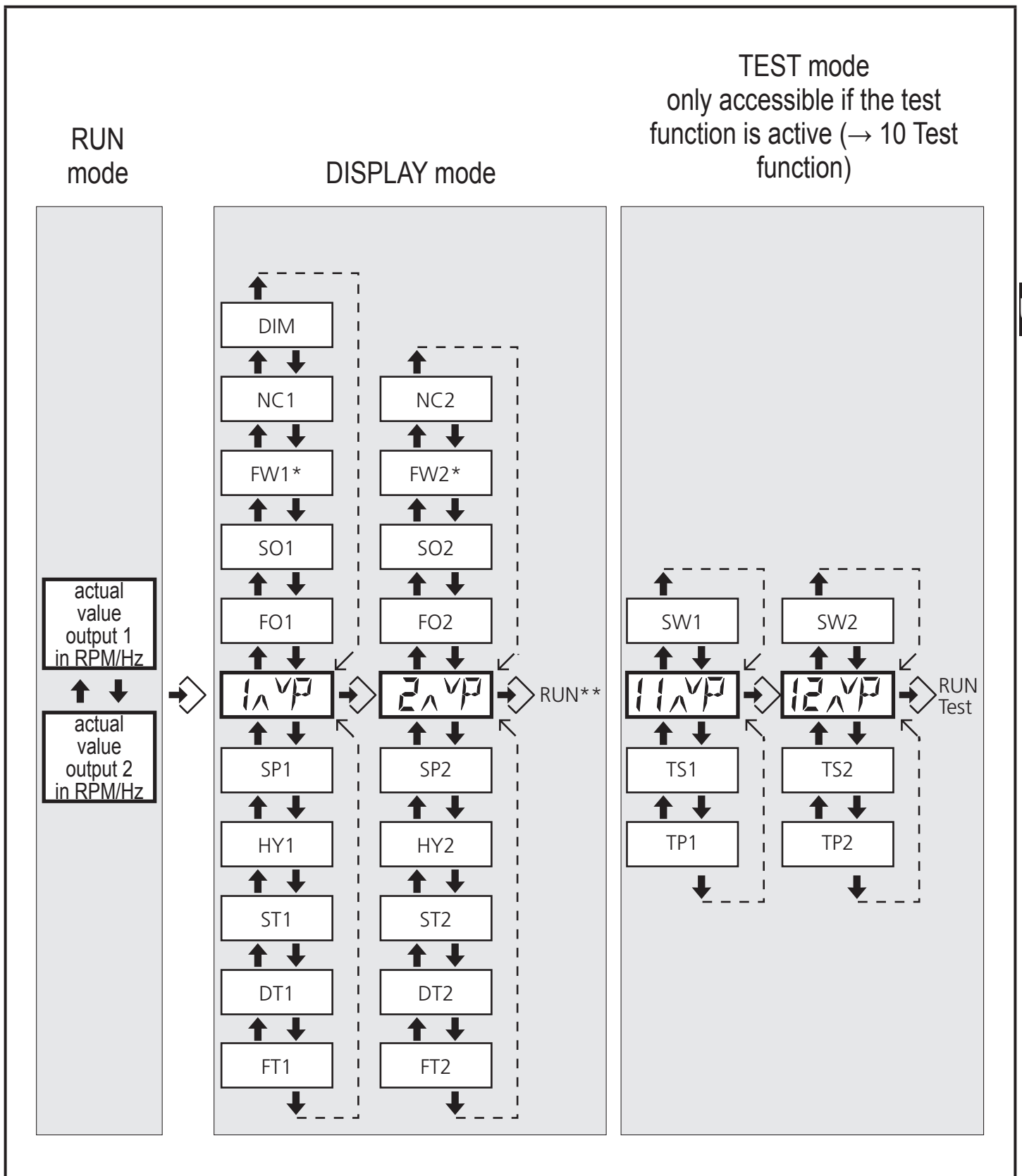
A special field in each column is used to move from the current to the following column (stepping parameter). In the display the number of the output, arrow symbols and the letter P are indicated: The parameters above this field are system parameters (usually they are only set during commissioning). The parameters below this field are application parameters which are set / changed more often.

By pressing the push-buttons \uparrow and \downarrow you can move up and down within a column. When the highest or the lowest parameter has been reached, you return to the stepping parameter of the column.

By pressing the \rightarrow push-button you move right or left to another column: When you press the push-button once, you get from one of the measured values of column 0 to the stepping parameter of column 1, by pressing the push-button again briefly you get to the stepping parameter of column 2. By pressing the push-button once again you get back to column 0 (to the measured value displayed before).

NOTE:

- At any place within the columns 1 or 2 (it is not important whether on a setting parameter or the stepping parameter), you get back to column 0 by pressing the \rightarrow push-button for approx. 3 s.
- When the display shows a setting parameter, you return to the programming mode (to change the parameters) by pressing the \rightarrow push-button briefly.
- When no push-button is pressed for approx. 15 s, the unit returns to the Run mode (column 0, last measured value).



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*only for FR-2 N

** a) Changeover to the RUN mode b) Changeover to the test parameters if the test function is active

7 Programming



When making any alterations to the monitor it is advised to stop the machine or plant as any changes accepted by the monitor will have immediate effect on the operation of the monitor.

7.1 Default back to basic factory settings (Factory Reset)

The basic settings made in the factory can be re-entered by pressing **↑** and **↓** simultaneously when power is applied. All the parameters you entered are lost.

7.2 Locking / Unlocking

The unit can be locked so that unintentional incorrect entries can be avoided:

Press the push-buttons **↑** and **↓** simultaneously and hold them. The "KEY" indicator is flashing.



Release the push-buttons when the indicator is constantly lit in the display.
















For unlocking press the push-buttons **↑** and **↓** simultaneously and hold them. The "KEY" indicator is flashing.

Release the push-buttons when the indicator is no longer displayed.

Programming consists of 3 steps:

1. Selection of the parameter,
2. Change and storage of the parameter,
3. Exit the programming mode.

| | | | |
|----------|---|---|--|
| 1 | Selection of the parameter to be changed | 1a) Press the → push-button briefly to get to the parameter range 1, press it once again to get to range 2 and a third time to get to range 3. |  <p>The unit is in the Display mode, the parameter range is displayed.</p> |
| | | 1b) Press the ↑ or ↓ push-button until the desired parameter is displayed. |  <p>The actual value and the abbreviation of the parameter are displayed.</p> |
| | | When the → push-button is pressed for approx. 3 s or when no push-button is pressed for approx. 15 s, the unit exits the Display mode and returns to the Run mode. | |

| | | | |
|---|---|---|---|
| 2 | Setting of parameter | <p>2a) Press the  push-button once briefly.</p> |  <p>The unit is in the Programming mode (PRG indicator, flashing abbreviation).</p> |
| | | <p>2b) Press the  or  push-button until the desired parameter value is displayed.</p> |  <p>The new parameter value is displayed.</p> |
| | | <p>Press the  or  push-button and hold it. The smallest decade becomes active and counts until "0" is reached. Then the next decade starts. Set the active decade by pressing the push-button once. Then the preceding decade is flashing and can be set.</p> | |
| | | <p>2c) Press the  push-button until the parameter abbreviation is no longer flashing and the PRG indicator no longer displayed (= acknowledgement / storage).</p> |  <p>The new parameter value is displayed and effective.</p> |
| | | <p>When you press the  push-button only briefly or when no push-button is pressed for approx. 15 s, the changed parameters are not stored. The initial parameter value is re-entered and remains effective. The unit returns to the Display mode and indicates the old parameter value which is still the actual value.</p> | |
| 3 | Setting of additional parameters or exiting the Programming mode | <p>Setting of additional parameters: Press the  or  push-button until the desired parameter is displayed and continue with step 2a).</p> |  <p>The abbreviation and the actual value of the selected parameter are displayed.</p> |
| | | <p>Exiting the Programming mode: Press the  push-button for approx. 3 s.</p> |  <p>The unit is in the Run mode, the actual value is displayed.</p> |

8 Mounting



Mount the unit in a control cabinet with a protection rating of at least IP 54 to guarantee protection against accidental contact with voltages and against atmospheric influence. The control cabinet should be installed in accordance with local and national rules and regulations.

Mount the unit on a DIN rail or by means of a mounting base. Once mounted leave enough space between the unit and the top and bottom of the control cabinet (to enable air circulation and to avoid excessive heating).

When several units are mounted side by side, the internal heating of all units has to be considered. The ambient temperature for the individual unit must not exceed the permissible value of 60 °C.

8.1 Mounting of the sensors

Adhere to the mounting instructions of the manufacturer.

9 Electrical connection



The unit must be installed by a qualified electrician.

Adhere to the national and international regulations for the installation of an electrotechnical plant.

Avoid contact with voltages.

Disconnect the plant from power before wiring. Check if the relays are connected to voltages of external power supplies.

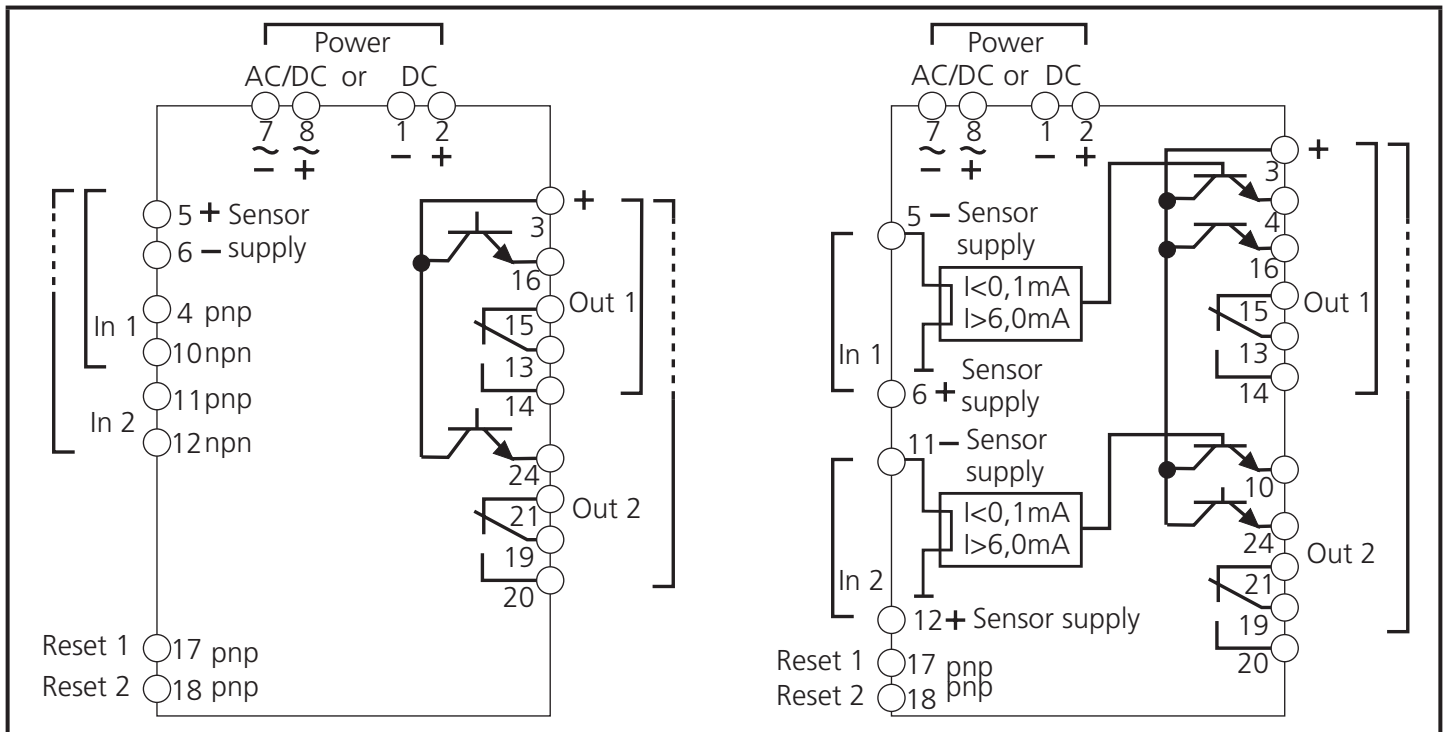
Terminals without internal connection (n. c.) must not be connected.

Protect the unit from ESD pulses which may result from discharge of your body.

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To guarantee safe functioning, signal cables and load cables should be laid separately. Use screened cable if necessary.

9.1 Terminal connection



9.1.1 Power supply (Power)

Power supply either

- at terminals 7 and 8 (AC / DC; for DD2002 only AC)
- or at terminals 1 and 2 (24 VDC).

The supply voltage must be protected by external measures.

The terminals of the DC supply are directly linked with the terminals of the sensor supply. This is why the SELV criteria must be adhered to for DC supply (protective low voltage, circuit galvanically separated from other circuits, not earthed).

If the DC circuit is to be earthed (e.g. because of national regulations), the PELV criteria have to be adhered to (protective low voltage, circuit galvanically separated from other circuits).

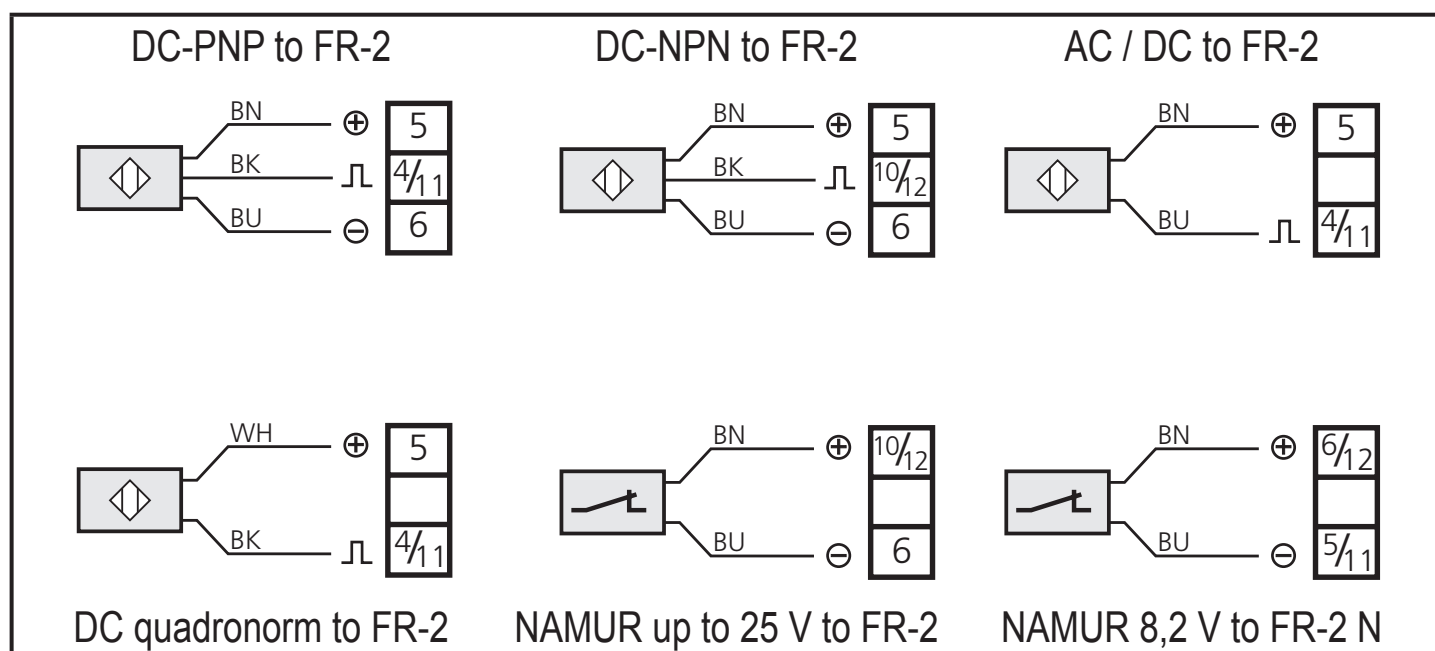
If the unit is supplied with AC voltage, the low voltage supply for the sensors meets the SELV criteria.

The device shall be supplied from an isolating source and protected by an overcurrent protection device such that the limited voltage circuit requirements in accordance with UL 508 are met.

9.1.2 Connection of pulse pick-ups (In 1, 2)

Monitor FR-2 provides approx. 24 V DC (max. 15 mA) for the supply of pulse pick-ups or for the external reset. Pulse pick-ups which need higher voltage / higher current consumption must have an external supply. In this case the reference point of the external voltage must be connected to terminal 1; the positive pole of the external power supply must not have any direct link with the monitor. A positive switching pulse pick-up must be connected to terminals 4 / 11, a negative switching pulse pick-up to terminals 10 / 12 (only one pulse pick-up can be connected).

Terminals 5 and 6 can only be used for the sensor supply or for the external reset but not for an external voltage supply.



Monitor FR-2 N provides 8.2 V DC for the supply of NAMUR pulse pick-ups.

This supply voltage for pulse pick-ups meets the SELV criteria if the monitor is supplied with AC voltage. (AC operating voltage circuit and supply voltage circuit are galvanically separated).

The supply voltage for pulse pick-ups meets the SELV criteria even in case of a DC supply of the monitor if the SELV criteria are adhered to for the DC supply (see above).

Please also adhere to the SELV criteria for the sensor connection so that there is no dangerous contact voltage at the sensor which can enter the unit!

9.1.3 Reset circuits (Reset 1, 2)

If an external start of the start-up delay or the reset for the latched output function is to be possible, an external voltage of 24 V DC is to be supplied at the terminal 17 or 18. UK

For the monitor FR-2 the terminal 5 can be connected to terminal 17 or 18 via a NO push-button / switch / plc relay output (not for the monitor FR-2 N).

The negative reference point of this voltage must be terminal 1 of the monitor.

A continuous 24 V signal continuously overrides the monitoring function, i.e. the same state is signalled, as is the case during the start-up delay. Monitoring is started when this voltage is interrupted and the set start-up delay has elapsed.

9.1.4 Load circuits transistor (Out 1, 2)

If you use the respective transistor outputs at terminals 16 and 24, these terminals need a common external supply of 24 V DC at terminal 3. This voltage should not be taken from the supply voltage of the pulse pick-up. The reference point of the external power supply must be linked with terminal 1 of the monitor, otherwise switching is not possible.

The device shall be supplied from an isolating source and protected by an overcurrent protection device such that the limited voltage circuit requirements in accordance with UL 508 are met.

9.1.5 Load circuits relay outputs (Out 1, 2)

The monitor has 2 potential-free changeover contacts: terminals 13, 14, 15 (= output 1) and terminals 19, 20, 21 (= output 2). If the unit often switches high external inductive loads, you should protect the contacts against interference to meet the EMC regulations and to avoid excessive wear and tear.

9.1.6 Load circuits fault outputs (FR-2 N)

The fault outputs (terminals 4 and 10) signal a wire fault between the monitor and the pulse pick-up (wire break / short circuit). In case of a fault the corresponding output is blocked.

10 Test function

The test function allows you to test the switching characteristics of the monitor off-line after programming.

To activate the test function press the  push-button while the operating voltage is applied to the monitor.

The TEST indicator is displayed and the monitor automatically runs through a defined frequency range with the outputs switching according to the selected switching functions and switch points as if a pulse pick-up generated the respective frequency.

Three test parameters are accessible simultaneously. They define the initial value and the final value of the frequency range as well as the speed with which the monitor runs through this range.

10.1 TSx

Test start frequency on input x:

Determines the initial value of the frequency range through which the monitor runs during the test.

Range of values: 1...60000 RPM or 1.0...1000.0 Hz.

Presetting in the factory 50 RPM.

10.2 TPx

Test stop frequency on input x:

Determines the final value of the frequency range through which the monitor runs during the test.

Range of values: 1...60000 RPM or 1.0...1000.0 Hz.

Presetting in the factory 1500 RPM.

10.3 SWx

Sweep speed on input x:

Determines the speed with which the monitor runs through the test frequency range.

Range of values: 1...5 (1 = fastest, 5 = slowest sweep).

Presetting in the factory 1.

Test parameters:

The test parameters are given in the 3rd and 4th column of the parameter table with the stepping parameter 11 and 12 (→ 6.5 Parameter table / Navigating).

You can move within the table as explained above. Since the test function is available in the complete parameter table, you can also change the operating parameters in the same way to optimise the setting of the unit!

The test function is terminated by switching off the unit.

UK

11 Commissioning / Operation

After mounting, wiring and programming check the safe functioning of the unit, especially whether the connected sensors and actuators are integrated into the process in a correct manner.

Check whether the external SELV circuits are sufficiently insulated.



If parameters are changed while the unit is operating, it can lead to the plant / machine being monitored incorrectly. It is advised that the unit is disconnected from the plant / machine while changes are made. The changes can be tested via the test function before reconnection to the plant / machine.


12 Maintenance / Repair / Disposal

In case of correct use no maintenance measures are necessary.

Depending on the switching rate to be expected and the load to be switched, we recommend testing the relay contacts.

Only the manufacturer is allowed to repair the unit.

In case of technical queries it can be helpful to indicate the current software version. This information is provided in the display mode.

- Select the parameter VER (it is above the parameter DIM,
- see parameter table (→ 6.5 Parameter table / Navigating)
- Briefly press the -push-button to show the number of the current software
- version (a 5-digit number and the abbreviation VCO).

After use dispose of the unit in an environmentally friendly way according to the valid national regulations.

13 Technical data

13.1 Power supply (DC or AC)

DC supply for all units

24 Volt DC $\pm 10\%$, at the terminals 1 (-) and 2 (+); protected against reverse polarity, current is to be limited to 6 A by external measures (e.g. fuse).

An external DC voltage supply must meet the SELV requirements. For this supply voltage the unit is classified in protection class 3.

Power consumption max. 3 W.

Supply for units with transformer power supply (DD2002):

According to the type label AC voltage $\pm 10\%$ at the terminals 7 and 8, frequency range 50...60 Hz.

For this supply the unit is classified in protection class 2 except for the terminal blocks. The protective low voltage generated within the unit for the monitor supply and pulse pick-up supply meets the SELV criteria according to overvoltage category 2 and soiling degree 2.

Power consumption max. 5 VA / 3 W.

Supply for units with AC / DC switched-mode power supply (DD2005, DD2006, DD2105, DD2106):

According to the type label AC or DC voltage $\pm 10\%$ at the terminals 7 and 8, AC frequency range 50...60 Hz.

For this supply the unit is classified in protection class 2 except for the terminal blocks.

The protective low voltage generated within the unit for the monitor supply and pulse pick-up supply meets the SELV criteria according to overvoltage category 2 and soiling degree 2.

Power consumption max. 5 VA.

13.2 Inputs

Pulse pick-up connection FR-2:

Terminals 4 and 11 for pnp-switching 24 V DC pulse pick-ups.

Terminals 10 and 12 for npn-switching 24 V DC pulse pick-ups and for NAMUR sensors to EN 50227 which are suited for 24 VDC.

Only pulse pick-ups of the same type (either pnp pulse pick-ups or npn pulse pick-ups) can be connected.

Current consumption: approx. 10 mA.

Switch point for pnp pulse pick-up: ≥ 12 V ON; < 5 V OFF

Switch point for npn pulse pick-up: ≥ 15 V OFF; ≤ 8 V ON

The maximum input frequency to be detected is 5 kHz (corresponds to a minimum duration for pulse and pause of 0.1 ms).

Pulse pick-up connection FR-2 N:

NAMUR pulse pick-ups 8.2 V according to EN 50227 at terminal 5 / 11 (-) and terminal 6 / 12 (+).

Typ. switch point: ≤ 1.55 mA ON; ≥ 1.75 mA OFF

Wire monitoring responds at < 0.1 mA (wire break) / > 6 mA (short circuit).

The maximum input frequency to be detected is 5 kHz (corresponds to a minimum duration for pulse and pause of 0.1 ms).

Pulse pick-up supply:

FR-2: Voltage: typ. 24 V DC; Current rating: max. 15 mA, protected against short circuit and overload.

For external DC supply of the monitor via the terminals 1 and 2 the supply voltage of the pulse pick-up corresponds to the DC supply voltage, less a low voltage for the short-circuit protection.

For external supply of the monitor via the transformer or switched-mode power supply (terminals 7 and 8) the supply voltage of the pulse pick-up corresponds to the rectified non-stabilised output DC voltage of the internal transformer (nominal 24 V).

FR-2 N: Voltage: typ. 8.2 V DC

Reset inputs 1 and 2:

Reset for output 1 = terminal 17;

Reset for output 2 = terminal 18.

Current consumption: typ. 2.5 mA at 24 V DC.

Switch point for positive switching is specified > 14 Volt.

13.3 Outputs

Output relay:

Switching capacity: max. 250 V, 8 A.

The current has to be limited to these values by appropriate external measures.

Relay of output 1: terminals 13 (COM), 14 (NO), 15 (NC).

Relay of the output 2: terminals 19 (COM), 20 (NO), 21 (NC).

Rated for overvoltage category 2 and soiling degree 2.

All inputs and relay contacts are galvanically separated from supply voltages, tested to a maximum of 250 V AC.

NOTE: If the relay is used to switch very low currents (e.g. plc inputs), considerable contact resistance can arise, use the transistor outputs for these purposes. The life of the relay contacts is considerably reduced by excess current or by the switching of unprotected inductive loads.

Transistor outputs:

Positive switching, external supply at terminal 3.

Maximum voltage supplied: nom. 24 V DC \pm 20 % incl. residual ripple, maximum switching current: 15 mA

Depending on the function the voltage is switched to terminal 16 for output 1 and to terminal 24 for output 2. They are protected against short circuits.

It is not allowed to apply external voltage to terminals 16 and 24!

Only for FR-2 N the voltage on terminal 3 is switched to terminal 4 and terminal 10 (fault outputs) depending on the function. The outputs are protected against short circuits.

Response time of the outputs:

The time between the moment when the preset value is exceeded or not reached and the switching of the output relay depends on the measuring time and the switching time of the relay.

Overspeed is detected without delay after each measurement.

Underspeed is detected depending on the measuring time which itself depends on the input frequency (i.e. on the speed at which the output is switched (SP) and the number of switching cams):

Measuring time at

- SP = 1000 RPM and 6 cams (= 6000 pulses / min): 10 ms
- SP = 1000 RPM and 1 cam (=1000 pulses / min): 60 ms
- SP = 100 RPM and 1 cam (= 100 pulses / min): 600 ms
- SP = 10 RPM and 1 cam (= 10 pulses / min): 6 s
- SP = 1 RPM and 1 cam (= 1 pulse / min): 60 s

Typical relay switching times are 10...20 ms to energise and 30...40 ms to drop out. The switching time of the transistor outputs depends on the measuring time alone.

Unit data:

Housing: DIN rail mounting, plastic

Dimensions: H / W / D: 78 / 45 / 120 mm

Weight: 490 g

Protection rating housing: IP 50

Protection rating terminals IP 20

Connection: 21 dual-chamber terminals

Wire cross section: max: 2 x 2.5 mm²

Environmental conditions:

Permissible ambient temperature: -20...+60 °C in open air

Humidity: max. 75 % up to +35 °C, non condensing

Air pressure: 75 KPa to 106 KPa

Maximum operating altitude: 2000 m above sea level

Characteristic values:

Accuracy of the frequency measurement: $\leq 1 \%$

Start-up delay typ.: 300 ms

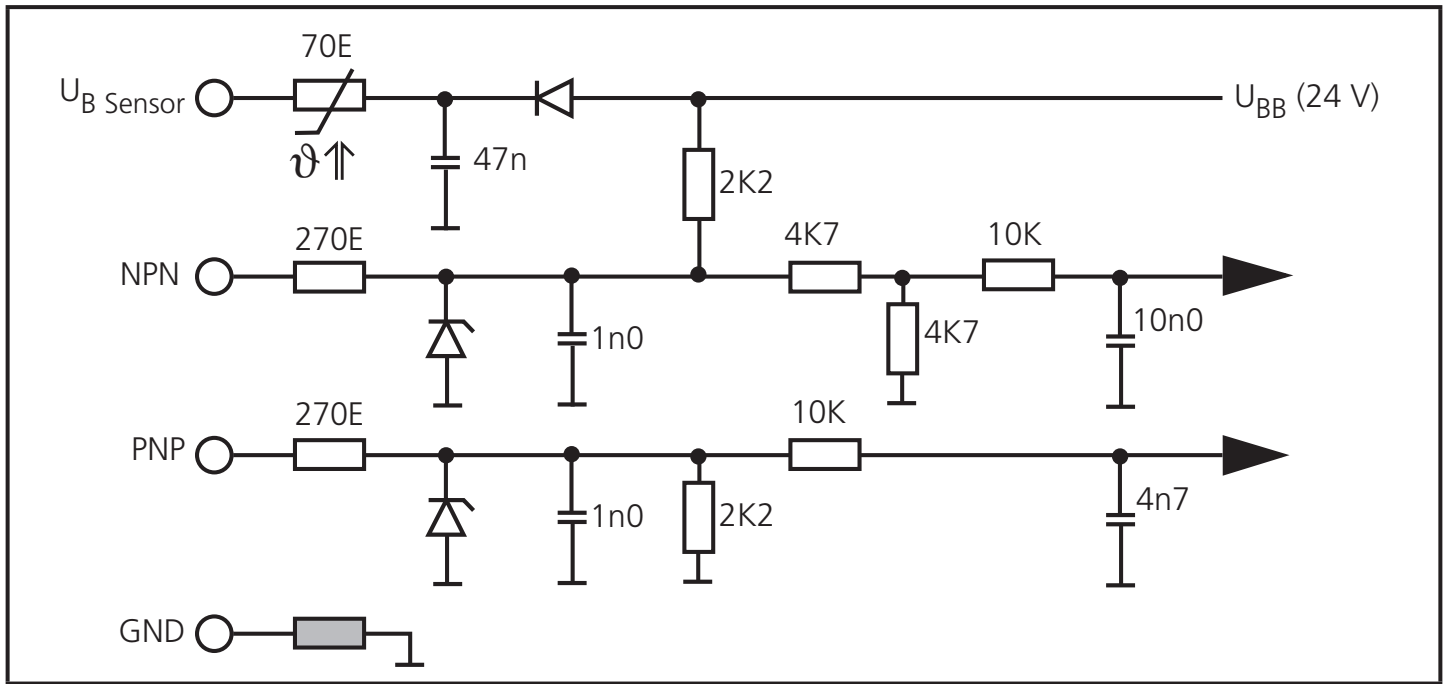
CE marking:

The unit has the CE mark which is necessary for the free exchange of good within Europe. It shows that the unit meets the requirements according to the accepted general protective purposes. In particular it shows the conformity with the following guidelines:

- EMC guideline EMC 89 / 336 / EEC, stipulated in the standards EN50081-1 and EN50082-2. (The user is responsible for the interference suppression of the relay circuit according to the standard).
- Low voltage guideline LV 73 / 23 / EEC, stipulated in the standard EN61010:1993 + A2:1995


Other requirements, e.g. concerning the EC guideline for machines, are to be considered by the user in his planned application and are not part of the certificate of conformity.

14 Input circuit diagram (typ.) for FR-2



15 Notes on the cULus certification

HINWEISE / NOTES / REMARQUES

| Bezeichnung designation désignation | Typ type forme | Artikel-Nr. order no. N° de commande |  |
|---|----------------------|--|---|
| Stillstandswächter standstill monitor contrôleur d'arrêt | A300 | DA0116 ¹⁾ , DA0122 ²⁾ | |
| Drehzahlwächter speed monitor contrôleur de vitesse de rotation | D100 | DD0116 ¹⁾ , DD0122 ²⁾ | |
| Monitor monitor boîtier | FR-x FR-xN | DD2003 ¹⁾ , DD2004 ³⁾ , DD2005 ¹⁾ , DD2006 ³⁾ DD2103 ¹⁾ , DD2104 ³⁾ , DD2105 ¹⁾ , DD2106 ³⁾ | |
| Monitor monitor boîtier | FD-x FD-xN | DR2003 ¹⁾ , DR2004 ³⁾ , DR2005 ¹⁾ , DR2006 ³⁾ DR2103 ¹⁾ , DR2104 ³⁾ , DR2105 ¹⁾ , DR2106 ³⁾ | |
| Monitor monitor boîtier | FS-x FS-xN | DS2003 ¹⁾ , DS2004 ³⁾ , DS2005 ¹⁾ , DS2006 ¹⁾ DS2103 ¹⁾ , DS2104 ³⁾ , DS2105 ¹⁾ , DS2106 ¹⁾ | |

Hinweise zur cULus-Zertifizierung

Gemäß der Zertifizierung entsprechen die o.g. Geräte folgenden technischen Daten:

Nennspannung AC/DC

¹⁾ 110...240 V (50...60 Hz)

²⁾ 27...60 V (50...60 Hz)

³⁾ 23...60 V (50...60 Hz)

Toleranz: -20...+10%

Nennspannung DC

alle o.g. Geräte

27 V (typ. 24 V),

Toleranz: -20...+10%

Kontaktbelastbarkeit

Gemäß cULus-Klassifizierung
6 A (250 V AC), B300, R300

Prüfbedingungen

Gehäuseabmessungen für die
Erwärmungsprüfung
200 x 200 x 150 mm.

Anschlußklemmen

bis 2,5 mm²; AWG 14

Notes on the cULus certification

According to the certification the above-mentioned units correspond to the following technical data:

Nominal voltage AC/DC

¹⁾ 110...240 V (50...60 Hz)

²⁾ 27...60 V (50...60 Hz)

³⁾ 23...60 V (50...60 Hz)

Tolerance: -20...+10%

Nominal voltage DC

All above-mentioned units

27 V (typ. 24 V),

Tolerance: -20...+10%

Contact rating

According to cULus classification
6 A (250 V AC), B300, R300

Test conditions

Housing dimensions for the
temperature-rise test
200 x 200 x 150 mm.

Connection terminals

Up to 2.5 mm²; AWG 14

Remarques sur la certification cULus

Selon la certification les appareils mentionnés ci-dessus correspondent aux données techniques suivantes:

Tension nominale AC/DC

¹⁾ 110...240 V (50...60 Hz)

²⁾ 27...60 V (50...60 Hz)

³⁾ 23...60 V (50...60 Hz)

Tolérance: -20...+10%

Tension nominale DC

Tous les appareils mentionnés

ci-dessus

27 V (typ. 24 V),

Tolérance: -20...+10%

Pouvoir de coupure

Selon la classification cULus
6 A (250 V AC), B300, R300

Conditions d'essai

Dimensions du boîtier pour
l'essai d'échauffement
200 x 200 x 150 mm.

Bornes de raccordement

Jusqu'à 2,5 mm²; AWG 14