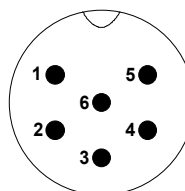


Operating manual for: **Px-x-xxxxM-D6x-1-C101-xx1**
Rx-x-xxxxM-D6x-1-C101-xx1
Px-x-xxxxM-Pxx-1-C101-xx1
Rx-x-xxxxM-Pxx-1-C101-xx1

Release: 03/98

Connecting diagram:

- 1 – gray - CAN_L (dominant low)
- 2 – pink - CAN_H (dominant high)
- 5 – brown - +24V DC
- 6 – white - 0V



List of Commands, Data Length Codes and Dataformats

| Parameter | Function | COB-Id | DLC | Command/Data |
|----------------------------------|--------------|-------------|-----|---|
| Broadcastmessage | Node Start | Broadc. Id. | 2 | 01, 00 (for all nodes) 01, NId (only for one node) |
| Broadcastmessage | Node Stop | Broadc. Id. | 2 | 02, 00 (for all nodes) 02, NId (only for one node) |
| Nodeidentifier | request | 2021 (7E5) | 5 | 01, SS, SS, SS, SS |
| | program | 2021 (7E5) | 6 | 02, SS, SS, SS, SS, XX |
| Positionidentifier | request | 2026 (7EA) | 2 | NId, 01 |
| | program | 2026 (7EA) | 4 | NId, 02, XX, XX |
| Broadcastidentifier | request | 2026 (7EA) | 2 | NId, 03 |
| | program | 2026 (7EA) | 4 | NId, 04, XX, XX |
| Limitswitchidentifier | request | 2026 (7EA) | 2 | NId, 05 |
| | program | 2026 (7EA) | 4 | NId, 06, XX, XX |
| Operational mode and protocol | request | 2026 (7EA) | 2 | NId, 07 |
| | program | 2026 (7EA) | 3 | NId, 08, XX |
| Sampling period | request | 2026 (7EA) | 2 | NId, 09 |
| | program PROM | 2026 (7EA) | 3 | NId, 0A, XX |
| | program RAM | 2026 (7EA) | 3 | NId, 0B, XX |
| Lower static limit | request | 2026 (7EA) | 2 | NId, 0C |
| | program | 2026 (7EA) | 5 | NId, 0D, XX, XX, XX |
| Upper static limit | request | 2026 (7EA) | 2 | NId, 0E |
| | program | 2026 (7EA) | 5 | NId, 0F, XX, XX, XX |

SS, SS, SS, SS - Serial Number;
 CANbus Single Magnet
 550774B

NId - Nodeidentifier;

XX – Userdata

| Parameter | Function | COB-Id | DLC | Command/Data |
|-------------------|----------|------------|-----|---------------------|
| Dynamical limit 1 | request | 2026 (7EA) | 2 | NId, 10 |
| | program | 2026 (7EA) | 5 | NId, 11, XX, XX, XX |
| Dynamical limit 2 | request | 2026 (7EA) | 2 | NId, 12 |
| | program | 2026 (7EA) | 5 | NId, 13, XX, XX, XX |
| Dynamical limit 3 | request | 2026 (7EA) | 2 | NId, 14 |
| | program | 2026 (7EA) | 5 | NId, 15, XX, XX, XX |

SS, SS, SS, SS - Serial Number;

NId - Nodeidentifier;

XX - Userdata

Explanation of Programming

During the installation or the programming of new data the transducer works as a slave. After each programming instruction the transducer answers with a recognition string so that the PLC can verify if the transducer gets the right information.

Nodeidentifier

The nodeidentifier is used for the fast and easy response of the CAN clients. Each CAN client gets his own nodeidentifier. This identifier is programmed during installation by using the serial number of the transducer (printed on transducer label). The serial number must be send in the following way:

serial number on transducer label: i.e. **FNr.:9702 0235**

serial number for communication protocol: 97 02 02 35

Requesting the nodeidentifier

| Source | COB-ID | Data | Destination |
|------------|--------|-------------------------|-------------|
| LMT Master | 2021 | 01; SS; SS; SS; SS | LMT Slave |
| LMT Slave | 2020 | 01; SS; SS; SS; SS; NId | LMT Master |

Programming the nodeidentifier

| Source | COB-ID | Data | Destination |
|------------|--------|-------------------------|-------------|
| LMT Master | 2021 | 02; SS; SS; SS; SS; NId | LMT Slave |
| LMT Slave | 2020 | 02; SS; SS; SS; SS; NId | LMT Master |

Positionidentifier

The positionidentifier is the identifier with which the transducer sends his position datas on the CAN bus. The position data could also be read by using a *remote frame* on the position identifier. The positionidentifier determines the priority of the message. A message with a low identifier has higher priority than a message with a high identifier.

Requesting the positionidentifier

| Source | COB-ID | Data | Destination |
|------------|--------|-----------------|-------------|
| NMT Master | 2026 | NId; 01 | NMT Slave |
| NMT Slave | 2025 | NId; 01; XX; XX | NMT Master |

Programming the positionidentifier

| Source | COB-ID | Data | Destination |
|------------|--------|-----------------|-------------|
| NMT Master | 2026 | NId; 02; XX; XX | NMT Slave |
| NMT Slave | 2025 | NId; 02; XX; XX | NMT Master |

Broadcastidentifier

The broadcastidentifier is used to send 'Node Start' and 'Node Stop' messages to the transducer. Normally the broadcastidentifier is the identifier 000 (based on Can Application Layer CAL), but sometimes it is necessary that the braodcastidentifier is another than the CAL based.

Requesting the broadcastidentifier

| Source | COB-ID | Data | Destination |
|------------|--------|-----------------|-------------|
| NMT Master | 2026 | NId; 03 | NMT Slave |
| NMT Slave | 2025 | NId; 03; XX; XX | NMT Master |

Programming the broadcastidentifier

| Source | COB-ID | Data | Destination |
|------------|--------|-----------------|-------------|
| NMT Master | 2026 | NId; 04; XX; XX | NMT Slave |
| NMT Slave | 2025 | NId; 04; XX; XX | NMT Master |

Limitswitchidentifier

The limitswitchidentifier is the identifier with which the transducer sends his status information regarding the limitswitch function. The limitswitchidentifier determines the priority of the message. A message with a low identifier has higher priority than a message with a high identifier. This message would be send directly when a change of the limitswitch function is detected. (This identifier is only used if this operational mode is selected).

Requesting the limitswitchidentifier

| Source | COB-ID | Data | Destination |
|------------|--------|-----------------|-------------|
| NMT Master | 2026 | NId; 05 | NMT Slave |
| NMT Slave | 2025 | NId; 05; XX; XX | NMT Master |

Programming the limitswitchidentifier

| Source | COB-ID | Data | Destination |
|------------|--------|-----------------|-------------|
| NMT Master | 2026 | NId; 06; XX; XX | NMT Slave |
| NMT Slave | 2025 | NId; 06; XX; XX | NMT Master |

Operational mode and protocol

- There are different kinds of operational modes. It can be select between CAN master or CAN slave mode. In CAN-Master mode the transducer sends automatical after measuring the position data on the bus. In the CAN-Slave mode the transducer does the measurement and waits for a Remote Frame on the positionidentifier to send the position data.
- It can be selected if the transducer sends a status information with a separate identifier or not. The status message is an one byte message which is directly send when a change of the limitswitch function is detected. This information would be send independent from the sample time of the transducer.
- By selection it is possible to measure the velocity of the movement of the magnet. The velocity information is added to the position information. The complete message is send out with the position identifier.
- There are two kinds of protocolformats available:
Protocolformat M: MSB-Position ... LSB Position, Status (MSB-Velocity, LSB-Velocity)
Protocolformat I : (LSB-Velocity, MSB-Velocity) Status, LSB-Position ... MSB-Position

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 0 | 0 | 0 | B3 | F | B2 | B1 | B0 |

- B0: 0 = with extra limitswitch message
1 = without extra limitswitch message
- B1: 0 = CAN-Master
1 = CAN-Slave
- B2: 0 = with velocity calculation
1 = without velocity calculation
- F: 0 = Protocolformat M
1 = Protocolformat I
- B3: 0 = free measurement
1 = measurement synchronus to 'Node Start'

Requesting the operational mode and protocol

| Source | COB-ID | Data | Destination |
|------------|--------|-------------|-------------|
| NMT Master | 2026 | NId; 07 | NMT Slave |
| NMT Slave | 2025 | NId; 07; XX | NMT Master |

Programming the operational mode and protocol

| Source | COB-ID | Data | Destination |
|------------|--------|-------------|-------------|
| NMT Master | 2026 | NId; 08; XX | NMT Slave |
| NMT Slave | 2025 | NId; 08; XX | NMT Master |

Sampling Period

Over the sampling period a selection could be made in which time periods the transducer sends its position data. The sampling must be a value between 1 and 255 (0x01 - 0xFF). The value 0 is not allowed. The time period t_{send} could be calculated with the sample s and the cycle time 0.5 ms (1 ms or 2 ms) as follows:

$$t_{send} = s * 0.5 \text{ ms (for transducer length 0 -> 1200 mm)}$$

$$t_{send} = s * 1.0 \text{ ms (for transducer length 1201 -> 2400 mm)}$$

$$t_{send} = s * 2.0 \text{ ms (for transducer length 2401 -> 4800 mm)}$$

$$t_{send} = s * 4.0 \text{ ms (for transducer length 4801 -> 9600 mm)}$$

The sampling period can be programmed in the permanent memory (EEPROM) or only in the RAM. Normally there is one sampling period programmed to the EEPROM and during production the sampling period is only changed in the RAM. After power up the transducer the sampling period stored in the EEPROM is automatically written in the RAM.

Requesting the sampling rate

| Source | COB-ID | Data | Destination |
|---------------|---------------|-------------|--------------------|
| NMT Master | 2026 | NId; 09 | NMT Slave |
| NMT Slave | 2025 | NId; 09; XX | NMT Master |

Programming the sampling rate to EEPROM

| Source | COB-ID | Data | Destination |
|---------------|---------------|-------------|--------------------|
| NMT Master | 2026 | NId; 0A; XX | NMT Slave |
| NMT Slave | 2025 | NId; 0A; XX | NMT Master |

Programming the sampling rate to the RAM

| Source | COB-ID | Data | Destination |
|---------------|---------------|-------------|--------------------|
| NMT Master | 2026 | NId; 0B; XX | NMT Slave |
| NMT Slave | 2025 | NId; 0B; XX | NMT Master |

Limit switch function

There are 5 limits to program. Two limits are fixed limits; these values are stored in an EEPROM. The other 3 limits are dynamical limits; these values are store in the RAM.

The limits are compared with the position data and the status of each comparison is send with the statusinformation.

The two static limits (low and high static limit) are security limits. The limit switch function may be programmed but it is not necessary to programm them.

Requesting the lower static limit

| Source | COB-ID | Data | Destination |
|---------------|---------------|---------------------|--------------------|
| NMT Master | 2026 | NId; 0C | NMT Slave |
| NMT Slave | 2025 | NId; 0C; XX; XX; XX | NMT Master |

Programming the lower static limit

| Source | COB-ID | Data | Destination |
|---------------|---------------|---------------------|--------------------|
| NMT Master | 2026 | NId; 0D; XX; XX; XX | NMT Slave |
| NMT Slave | 2025 | NId; 0D; XX; XX; XX | NMT Master |

Requesting the upper static limit

| Source | COB-ID | Data | Destination |
|---------------|---------------|---------------------|--------------------|
| NMT Master | 2026 | NId; 0E | NMT Slave |
| NMT Slave | 2025 | NId; 0E; XX; XX; XX | NMT Master |

Programming the upper static limit

| Source | COB-ID | Data | Destination |
|---------------|---------------|---------------------|--------------------|
| NMT Master | 2026 | NId; 0F; XX; XX; XX | NMT Slave |
| NMT Slave | 2025 | NId; 0F; XX; XX; XX | NMT Master |

Requesting the dynamical limit 1

| Source | COB-ID | Data | Destination |
|---------------|---------------|---------------------|--------------------|
| NMT Master | 2026 | NId; 10 | NMT Slave |
| NMT Slave | 2025 | NId; 10; XX; XX; XX | NMT Master |

Programming the dynamical limit 1

| Source | COB-ID | Data | Destination |
|---------------|---------------|---------------------|--------------------|
| NMT Master | 2026 | NId; 11; XX; XX; XX | NMT Slave |
| NMT Slave | 2025 | NId; 11; XX; XX; XX | NMT Master |

Requesting the dynamical limit 2

| Source | COB-ID | Data | Destination |
|---------------|---------------|---------------------|--------------------|
| NMT Master | 2026 | NId; 12 | NMT Slave |
| NMT Slave | 2025 | NId; 12; XX; XX; XX | NMT Master |

Programming the dynamical limit 2

| Source | COB-ID | Data | Destination |
|---------------|---------------|---------------------|--------------------|
| NMT Master | 2026 | NId; 13; XX; XX; XX | NMT Slave |
| NMT Slave | 2025 | NId; 13; XX; XX; XX | NMT Master |

Requesting the dynamical limit 3

| Source | COB-ID | Data | Destination |
|---------------|---------------|---------------------|--------------------|
| NMT Master | 2026 | NId; 14 | NMT Slave |
| NMT Slave | 2025 | NId; 14; XX; XX; XX | NMT Master |

Programming the dynamical limit 3

| Source | COB-ID | Data | Destination |
|---------------|---------------|---------------------|--------------------|
| NMT Master | 2026 | NId; 15; XX; XX; XX | NMT Slave |
| NMT Slave | 2025 | NId; 15; XX; XX; XX | NMT Master |

Node Start Message

The 'Node Start' message is used to switch the transducer active. Therefore the nodeidentifier of the transducer is need. Also with the 'Node Start' message all transducers could be switched active at the same time. Therefore the nodeidentifier 00 is necessary.

| Source | COB-ID | Data | Destination |
|---------------|---------------|-------------------|--------------------|
| NMT Master | Broadc.Id. | 01; 00 (for all) | NMT Slave |
| | Broadc.Id. | 01; NId (for one) | NMT Slave |

Node Stop Message

The 'Node Stop' message is used to switch the transducer passiv. Therefore the nodeidentifier of the transducer is need. Also with the 'Node Stop' message all transducers could be switched passiv at the same time. Therefore the nodeidentifier 00 is necessary.

| Source | COB-ID | Data | Destination |
|---------------|---------------|-------------------|--------------------|
| NMT Master | Broadc.Id | 02; 00 (for all) | NMT Slave |
| | Broadc.Id. | 02; NId (for one) | NMT Slave |

Position message format without velocity calculation

The dataformat can be protocolformat M or protocolformat I.

Protocolformat M

| Ident. | DLC | D0 | D1 | D2 | D3 |
|---------------|------------|----------------------|----------------------|---------------------|-----------|
| Pos.Id. | 4 | Highbyte Position | Med.byte Position | Lowbyte Position | Status |

Protocolformat I

| Ident. | DLC | D0 | D1 | D2 | D3 |
|---------------|------------|-----------|---------------------|----------------------|----------------------|
| Pos.Id. | 4 | Status | Lowbyte Position | Med.byte Position | Highbyte Position |

Together with the position there also the status of the transducer and the limitswitch comparison is send out. The resolution of the position depends on the ordering code on the label.

Position message format with velocity calculation

The dataformat can be protocolformat M or protocolformat I.

Protocolformat M

| Ident. | DLC | D0 | D1 | D2 | D3 | D4 | D5 |
|---------------|------------|----------------------|----------------------|---------------------|-----------|----------------------|---------------------|
| Pos.Id. | 6 | Highbyte Position | Med.byte Position | Lowbyte Position | Status | Highbyte Velocity | Lowbyte Velocity |

Protocolformat I

| Ident. | DLC | D0 | D1 | D2 | D3 | D4 | D5 |
|---------------|------------|---------------------|----------------------|-----------|---------------------|----------------------|----------------------|
| Pos.Id. | 6 | Lowbyte Velocity | Highbyte Velocity | Status | Lowbyte Position | Med.byte Position | Highbyte Position |

Together with the position there also the status of the transducer and the limitswitch comparison and also the velocity is send out. The resolution of the position respekt to the ordering guide. The resolution of the velocity depends on the resolution of the position and the measured velocity itself and changes automaticaly (see table next page).

Resolution of velocity (resolution of position data: **0.005 mm**):
the significance of LSB is constant 1,00 (0,50; 0,25) mm/s

| Velocity [mm/s] | Resolution [mm/s] | Timeintervall [ms] |
|---------------------------|-----------------------------|------------------------------|
| V > 640 | 10,00 (5,00 ; 2,50) | 0,5 (1,0 ; 2,0) |
| 640 > V > 320 | 5,00 (2,50 ; 1,25) | 1,0 (2,0 ; 4,0) |
| 320 > V > 213 | 3,33 (1,66 ; 0,83) | 1,5 (3,0 ; 6,0) |
| 213 > V > 128 | 2,00 (1,00 ; 0,50) | 2,5 (5,0 ; 10,0) |
| 128 > V > 0 | 1,00 (0,50 ; 0,25) | 5,0 (10,0 ; 20,0) |

The values in brackets are in response to transducer length more than 1,2 bzw. 2,4 m.

Resolution of velocity (resolution of position data: **0.002 mm**):
the significance of LSB is constant 0,40 (0,20; 0,10) mm/s

| Velocity [mm/s] | Resolution [mm/s] | Timeintervall [ms] |
|---------------------------|-----------------------------|------------------------------|
| V > 640 | 4,00 (2,00 ; 1,00) | 0,5 (1,0 ; 2,0) |
| 640 > V > 320 | 2,00 (1,00 ; 0,50) | 1,0 (2,0 ; 4,0) |
| 320 > V > 213 | 1,20 (0,60 ; 0,30) | 1,5 (3,0 ; 6,0) |
| 213 > V > 128 | 0,80 (0,40 ; 0,20) | 2,5 (5,0 ; 10,0) |
| 128 > V > 0 | 0,40 (0,20 ; 0,10) | 5,0 (10,0 ; 20,0) |

The values in brackets are in response to transducer length more than 1,2 bzw. 2,4 m.

The Status information looks like follows:

| | | | | | | | |
|----|----|-----|-----|-----|----|----|----|
| B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| x | SE | DL3 | DL2 | DL1 | UL | LL | ST |

- ST: Status Transducer
 - 0 = transducer ok
 - 1 = transducer failure
- LL: Status Lower Limit
 - 0 = position > lower limit
 - 1 = position < lower limit
- UL: Status Upper Limit
 - 0 = position < upper limit
 - 1 = position > upper limit
- DL1: Status Dynamical Limit 1
 - 0 = position < dynamical limit 1
 - 1 = position > dynamical limit 1
- DL2: Status Dynamical Limit 2
 - 0 = position < dynamical limit 2
 - 1 = position > dynamical limit 2
- DL3: Status Dynamical Limit 3
 - 0 = position < dynamical limit 3
 - 1 = position > dynamical limit 3
- SE: Status EEPROM
 - 0 = Checksum ok
 - 1 = Checksum failure



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