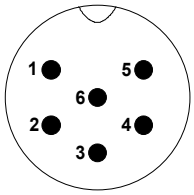
Operating manual for: **Px-x-xxxxM-D6x-1-C101-xx1**
Rx-x-xxxxM-D6x-1-C101-xx1
Px-x-xxxxM-Pxx-1-C101-xx1
Rx-x-xxxxM-Pxx-1-C101-xx1

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 program	2021 (7E5) 2021 (7E5)	5 6	01, SS, SS, SS, SS 02, SS, SS, SS, SS, XX
Positionidentifier	request program	2026 (7EA) 2026 (7EA)	2 4	NId, 01 NId, 02, XX, XX
Broadcastidentifier	request program	2026 (7EA) 2026 (7EA)	2 4	NId, 03 NId, 04, XX, XX
Limitswitchidentifier	request program	2026 (7EA) 2026 (7EA)	2 4	NId, 05 NId, 06, XX, XX
Operational mode and protocol	request program	2026 (7EA) 2026 (7EA)	2 3	NId, 07 NId, 08, XX
Sampling period	request program PROM program RAM	2026 (7EA) 2026 (7EA) 2026 (7EA)	2 3 3	NId, 09 NId, 0A, XX NId, 0B, XX
Lower static limit	request program	2026 (7EA) 2026 (7EA)	2 5	NId, 0C NId, 0D, XX, XX, XX
Upper static limit	request program	2026 (7EA) 2026 (7EA)	2 5	NId, 0E NId, 0F, XX, XX, XX

SS, SS, SS, SS - Serial Number; 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 answeres with a recognition string so that the PLC can verivy 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:

$t_{send} = s * 0.5\ ms$ (for transducer length 0 -> 1200 mm)
$t_{send} = s * 1.0\ ms$ (for transducer length 1201 -> 2400 mm)
$t_{send} = s * 2.0\ ms$ (for transducer length 2401 -> 4800 mm)
$t_{send} = s * 4.0\ ms$ (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 respekts 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 Statusinformation 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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