MELSEC System Q

Programmable Logic Controllers

User's Manual

NAMUR Input Module
ME1X16NA-Q

Art. no.: 260166
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Version A

MITSUBISHI ELECTRIC INDUSTRIAL AUTOMATION

Version check

About this Manual

The texts, illustration, diagrams and examples in this manual are provided for information purposes only. They are intended as aids to help explain the installation, operation, programming and use of the programmable logic controllers of the MELSEC System Q

If you have any questions about the installation and operation of any of the products described in this manual please contact your local sales office or distributor (see back cover).
You can find the latest information and answers to frequently asked questions on our website at www.mitsubishi-automation.com.

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NAMUR Input Module
ME1X16NA-Q
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1 Overview

This User's Manual describes the specifications, handling and programming methods for the NAMUR Input Module ME1X16NA-Q (hereinafter referred to as the ME1X16NA-Q) which is used with the programmable controllers of the MELSEC System Q.

Before using the ME1X16NA-Q, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC System Q series programmable controller to handle the product correctly.

1.1 Introduction

The ME1X16NA-Q is a digital input module for connection of up to 16 NAMUR sensors.

NAMUR is an international user association of automation technology in process industries. The principle of operation of a NAMUR sensor is based on the recommendations of this association.

In contrast to an ordinary binary sensor with only two states (ON and OFF), a NAMUR sensor can indicate four states: ON, OFF, wire break and short circuit.

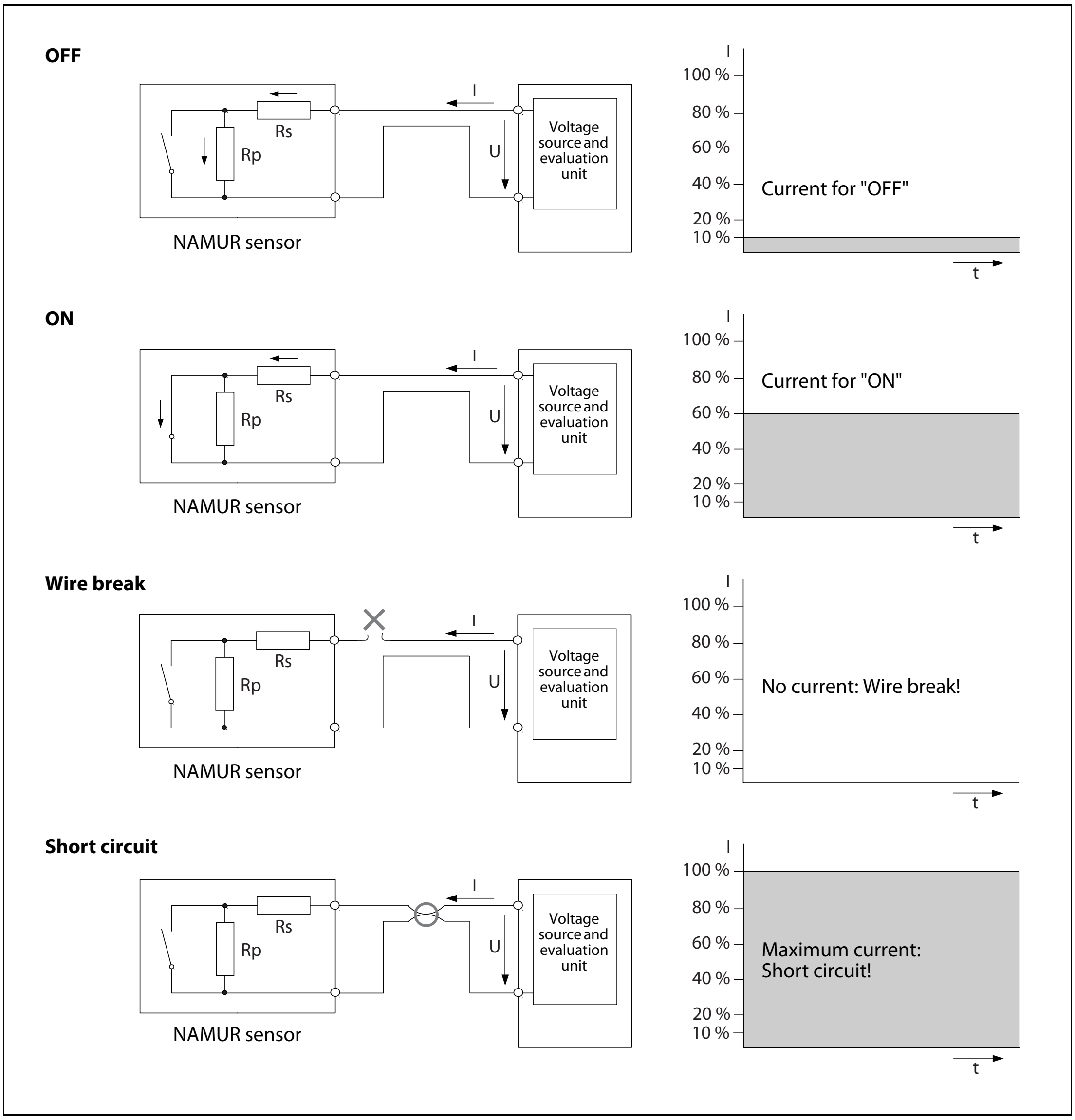


Fig. 3-1: *The sensor current is an indication of the four states of a NAMUR sensor*

1.2 Features of the ME1X16NA-Q

Connection of up to 16 NAMUR sensors

Up to 16 NAMUR sensors can be connected to a single ME1X16NA-Q. The ME1X16NA-Q supplies the voltage for the sensors and measures the current in order to detect their individual states.

Wire breaks and short circuits are recognised for each input. The respective input is "0" within the wire break or short circuit condition.

As an alternative to NAMUR sensors, contacts with an external resistor network can be used.

Event monitoring

The ME1X16NA-Q can monitor the sensor status (switched ON, switched OFF, wire break, short circuit, fluttering signal), and store the historical data of occurred events into an internal buffer.

Time stamping

Events are marked with a time stamp from the internal clock of the ME1X16NA-Q.

Pulse conditioning

The ME1X16NA-Q can blank out short pulses as well as stretch pulses to an adjustable minimum length.

Flutter monitoring

Fluttering input signals can be detected. This can be a hint for a defective sensor or a poorly adjusted target.

For a detailed description of the functions of the ME1X16NA-Q, please refer to section 3.3.

2 System Configuration

2.1 Applicable Systems

Applicable modules, base units, and No. of modules

- When mounted with a CPU module

  The table below shows the CPU modules and base units applicable to the NAMUR Input Module ME1X16NA-Q and quantities for each CPU model.

  Depending on the combination with other modules or the number of mounted modules, the power supply capacity may be insufficient. Pay attention to the power supply capacity before mounting modules, and if the power supply capacity is insufficient, change the combination of the modules.

Applicable CPU module			No. of ME1X16NA-Q that can be installed*1	Base unit*2	
CPU type		CPU model		Main base unit	Extension base unit
Programmable controller CPU	Basic model QCPU	Q00JCPU	Up to 16	●	●
		Q00CPU	Up to 24		
		Q01CPU			
	High performance model QCPU	Q02CPU	Up to 64	●	●
		Q02HCPU			
		Q06HCPU			
		Q12HCPU			
		Q25HCPU			
	Process CPU	Q02PHCPU	Up to 64	●	●
		Q06PHCPU			
		Q12PHCPU			
		Q25PHCPU			
	Redundant CPU	Q12PRHCPU	Up to 53	○	●
		Q25PRHCPU			
	Universal model QCPU	Q00UJCPU	Up to 16	●	●
		Q00UCPU	Up to 24	●	●
		Q01UCPU			
		Q02UCPU	Up to 36		
		Q□UD(E)CPU	Up to 64		
		Q50UDEHCPU			
		Q100UDEHCPU			
	Safety CPU	QS001CPU	—	○	○
C Controller module		Q06CCPU-V-H01	Up to 64	●	●
		Q06CCPU-V			
		Q06CCPU-V-B			
		Q12DCCPU-V			

Tab. 2-1: *Applicable base units and number of mountable modules*

● : Applicable, ○: Not applicable

*1 Limited within the range of I/O points for the CPU module.

*2 The ME1X16NA-Q can be installed to any I/O slot of a base unit.

- Mounting to a MELSECNET/H remote I/O station

  The table below shows the network modules and base units applicable to the analog output module ME1X16NA-Q and quantities for each network module model.

  Depending on the combination with other modules or the number of mounted modules, power supply capacity may be insufficient. Pay attention to the power supply capacity before mounting modules, and if the power supply capacity is insufficient, change the combination of the modules.

Applicable network module	No. of ME1X16NA-Q that can be installed*1	Base unit*2	
		Main base unit of remote I/O station	Extension base unit of remote I/O station
QJ72LP25-25	Up to 64	●	●
QJ72LP25G			
QJ72LP25GE			
QJ72BR15			

Tab. 2-2: *Applicable base units and number of mountable modules in a MELSECNET/H remote I/O station*

● : Applicable, ○: Not applicable

*1 Limited within the range of I/O points for the network module.

*2 The ME1X16NA-Q can be installed to any I/O slot of a base unit.

NOTES

The Basic model QCPU or C Controller module cannot create the MELSECNET/H remote I/O network.

When using the time stamping function for a NAMUR input module mounted in a remote I/O station, please consider the delay of the I/O signals and the clock data send to the module.

Support of the multiple CPU system

The function version of the NAMUR input module supports the multiple CPU system. When using the ME1X16NA-Q in a multiple CPU system, refer to the following manual first.

– QCPU User's Manual (Multiple CPU System)

- Intelligent function module parameters

  Write intelligent function module parameters to only the control CPU of the ME1X16NA-Q.

Compatibility with online module change

An online module change is a function that allows the module of the MELSEC System Q mounted on the main base unit or extension base unit to be changed during system control executed by a Process CPU or a Redundant CPU.

NOTE

The Basic model QCPU, High Performance model QCPU and Universal model QCPU are not compatible with an online module change.

Using an online module change, the module that failed during control can be replaced with the module of the same model name.

The ME1X16NA-Q does support online module change. It can be replaced online (while power is on) on any MELSECNET/H remote I/O station or in the system where a CPU module supporting the online module change function is used.

For details, refer to the relevant sections in the QCPU User's Manual (Hardware Design, Maintenance and Inspection).

Supported software packages

For setting the PLC parameters for a system containing the ME1X16NA-Q and programming the software packages GX Developer, GX IEC Developer and GX Works2 can be used.

Depending on the CPU module used, a certain version of the software is needed since newly CPU modules are not supported by previous versions.

2.2 How to Check the Function Version and Serial No. of the Modules

Using the programming software GX Developer, GX IEC Developer or GX Works2, the serial No. and the function version can be checked while the PLC is operating.

From the ***Diagnostics*** menu select ***System Monitor*** and then select ***Product Inf. List.***

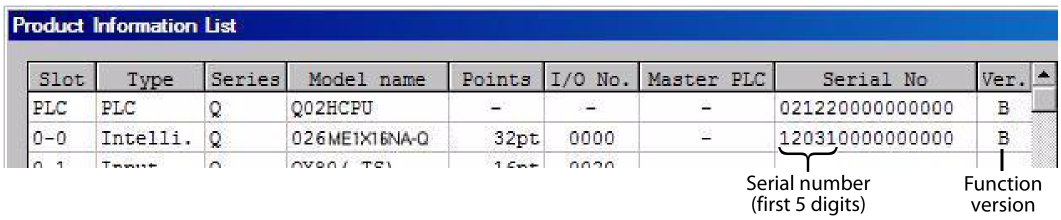


Fig. 2-1: *Product Information List for a PLC with a ME1X16NA-Q*

NOTE The serial number displayed on the product information screen of GX Developer, GX IEC Developer or GX Works2 describes the function information of the product. The function information of the product is updated when a new function is added.

3 Detailed Description of the Module

3.1 Part Names

This section explains the names of the components for the ME1X16NA-Q.

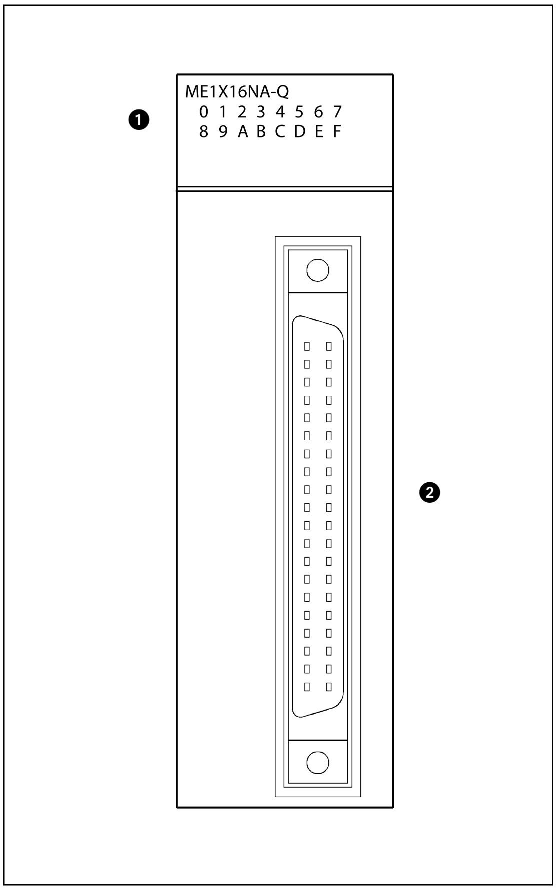
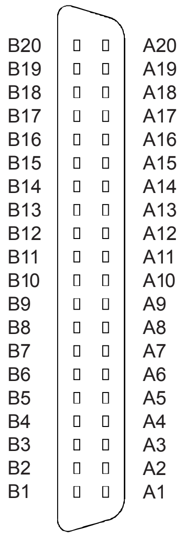


Fig. 3-1:
Names of parts

No.	Name	Description
❶	Indicator LEDs	Used to indicate the status of each input. (0: Input CH0 to F: Input CHF) On: Input is ON Off: Input is OFF
❷	40-pin connector	Used for connection of the NAMUR sensors and the external power supply.

Tab. 3-1: *Description of the LEDs and the connector of the ME1X16NA-Q*

3.1.1 Signal Layout of the Connector

Connector	Pin	Signal	Pin	Signal	Channel	Remark
 Module front view	B20	Vacant	A20	Vacant	—	—
	B19	DI0	A19	VS0	0	Digital inputs (DI) and voltage supply (VS) for the sensor. Connect the sensor to DI☐ and VS☐ (☐ = 0 to F).
	B18	DI1	A18	VS1	1	
	B17	DI2	A17	VS2	2	
	B16	DI3	A16	VS3	3	
	B15	DI4	A15	VS4	4	
	B14	DI5	A14	VS5	5	
	B13	DI6	A13	VS6	6	
	B12	DI7	A12	VS7	7	
	B11	DI8	A11	VS8	8	
	B10	DI9	A10	VS9	9	
	B9	DIA	A9	VSA	A	
	B8	DIB	A8	VSB	B	
	B7	DIC	A7	VSC	C	
	B6	DID	A6	VSD	D	
	B5	DIE	A5	VSE	E	
	B4	DIF	A4	VSF	F	
	B3	Vacant	A3	Vacant	—	—
	B2		A2			
	B1	24G	A1	24V	—	External power supply A1: +24 V DC B1: 0 V

Tab. 3-2: *Signal layout for the 40-pin connector of the ME1X16NA-Q*

> **WARNING:**
> ***Leave the "vacant" pins unconnected.***

For the wiring of the NAMUR input module ME1X16NA-Q please refer to section 4.4.

3.2 Specifications

The specifications for the ME1X16NA-Q are shown in the following table. For general specifications, refer to the operation manual for the CPU module being used.

Specification		**ME1X16NA-Q**
Number of NAMUR inputs		16 channels
Sensor voltage (from internal power supply)		8.2 V DC
ON current		>2.1 mA
OFF current		<1.2 mA
Hysteresis		0.2 mA
Wire break detection current		<0.2 mA
Short circuit detection current		>7.5 mA
Maximum short circuit current		8.9 mA
Response time	OFF to ON	3 ms/6 ms or less (configured in PLC parameter) ① (Default: 6 ms)
	ON to OFF	
Time stamping	Resolution	1 ms
Insulation method	Between the I/O terminals and PLC power supply	Digital isolator insulation
	Between I/O terminals and external power supply (24 V DC)	Photocoupler/transformer insulation
	Between channels	Non-insulated
Dielectric withstand voltage	Between I/O terminals and programmable controller power supply	500 V ACrms for 1 min
Insulation resistance		500 V DC 10 MΩ or higher
Number of occupied I/O points		32 points (I/O assignment: Intelligent 32 points)
External wiring connections	Connection system	40-pin connector
	Applicable connectors	A6CON1, A6CON2, A6CON3, A6CON4 (optional)
	Cable specification	Shielded cable
	Applicable wire size	0.3 mm^2 (A6CON1 and A6CON4), 0.08–0.2 mm^2 (A6CON2), 0.05 mm^2 (A6CON3, single wire), 0.08 mm^2 (A6CON3, stranded wire)
External supply power	Voltage	24 V DC (+20%, -15%); ripple ratio within 5%
	Current	0.15 A
	Inrush current	5.0 A within 230 µs
Online module change		Supported
Internal current consumption (5 VDC)		0.33 A
Weight		0.14 kg

Tab. 3-3: *Specifications of the ME1X16NA-Q*

① For the setting method, please refer to section 4.5.

3.2.1 Input Filter

The input signals are internally filtered to suppress any induced noise. The filter has an influence on the signal timing. This influence depends on the ON current and OFF current values of the connected NAMUR sensors.

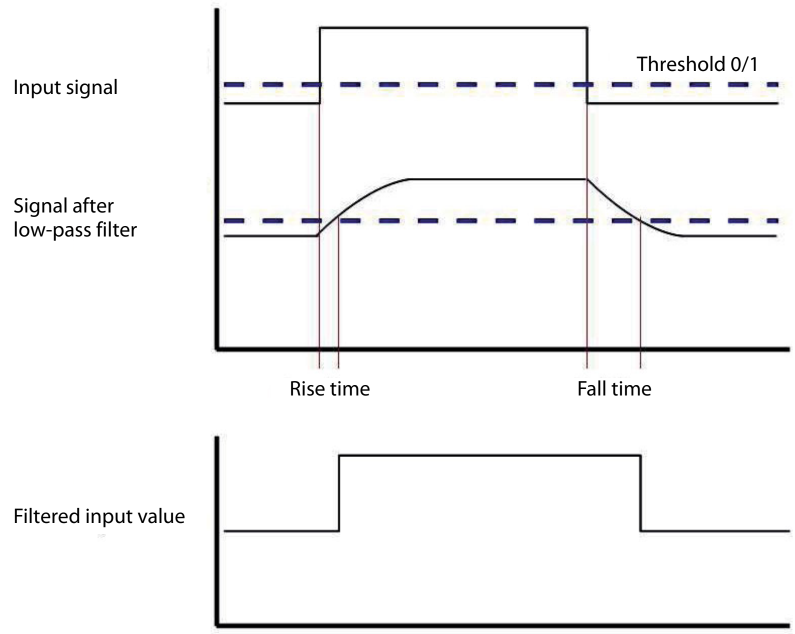


Fig. 3-2: *Distortion of input pulses*

A positive pulse will be extended by the distortion time after the input filter and a negative pulse will be reduced by the distortion time. The worst case distortion time is:

Max. fall time – min. rise time = 2.5 ms

3.2.2 External Dimensions

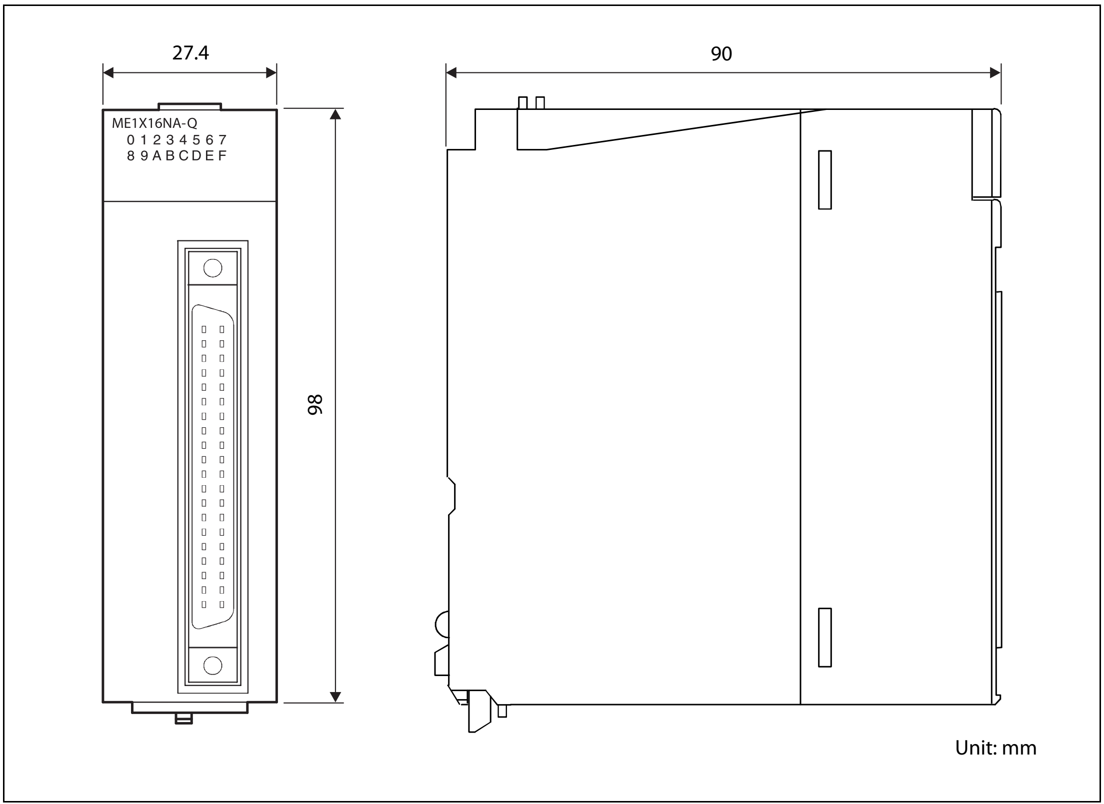


Fig. 3-3: *Dimensions of the ME1X16NA-Q*

3.3 Functions of the NAMUR Input Module

Function	Description	Reference section
Short pulse discrimination (filtering)	Short pulses of the input signal can be eliminated.	3.3.1
Pulse stretching	Input signals can be extended to an adjustable minimum value.	3.3.2
Flutter monitoring	Fluttering input signals can be detected.	3.3.3
Events	Signal changes of an input signal or errors can be defined as an event. When an event occurs, the relevant data is stored in the ME1X16NA-Q.	3.3.4

Tab. 3-4: *Functions of the ME1X16NA-Q*

Signal Flow

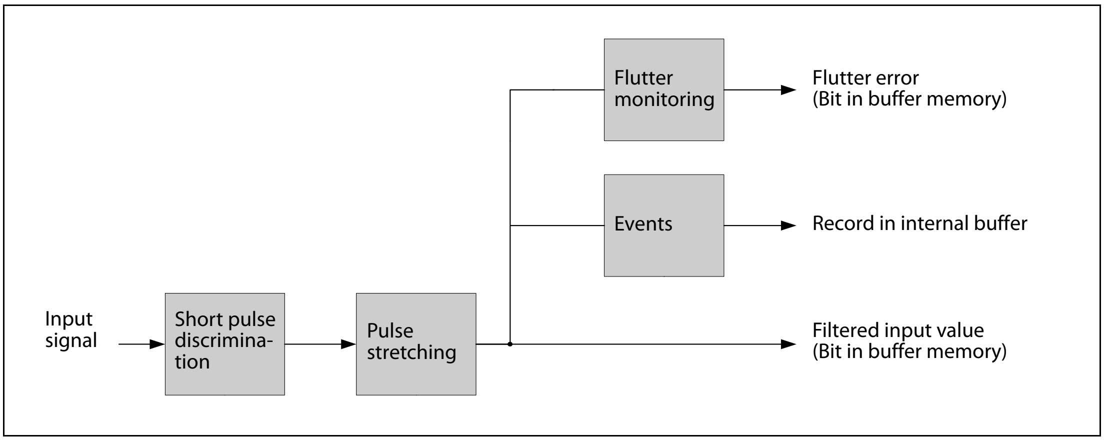


Fig. 3-4: *Signal flow of the ME1X16NA-Q*

3.3.1 Short Pulse Discrimination (Filtering)

The short pulse discrimination eliminates short pulses (positive or negative). The minimum allowed length for pulses is adjustable by the parameter T_0 in the range from 0 to 2 s in increments of 5 ms. If the parameter T_0 is set to 0, the function is disabled.

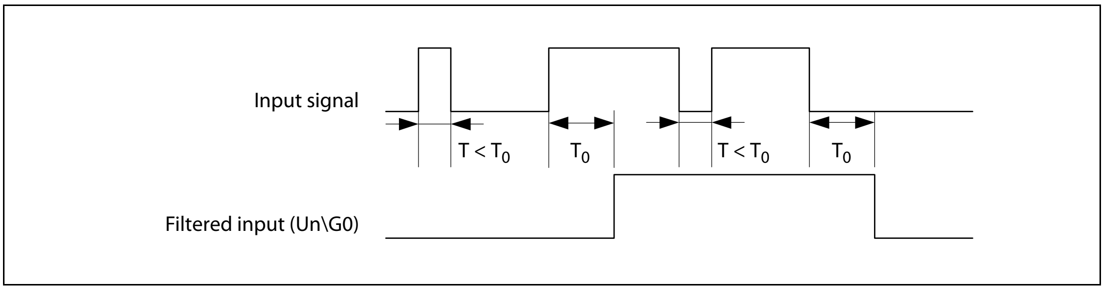


Fig. 3-5: *Pulses shorter than the time T_0 are not recognized as changes of the input signal*

The short pulse discrimination time can be set for each input in the buffer memory addresses Un\G30 to Un\G45 (refer to section 3.5.12).

3.3.2 Pulse Stretching

The pulse stretching function extends any filtered input signal pulse (positive or negative) to an adjustable minimum value (T_0). The parameter T_0 can be set in the range of 0 to 2 s in increments of 100 ms. If the parameter T_0 is set to 0, the function is disabled.

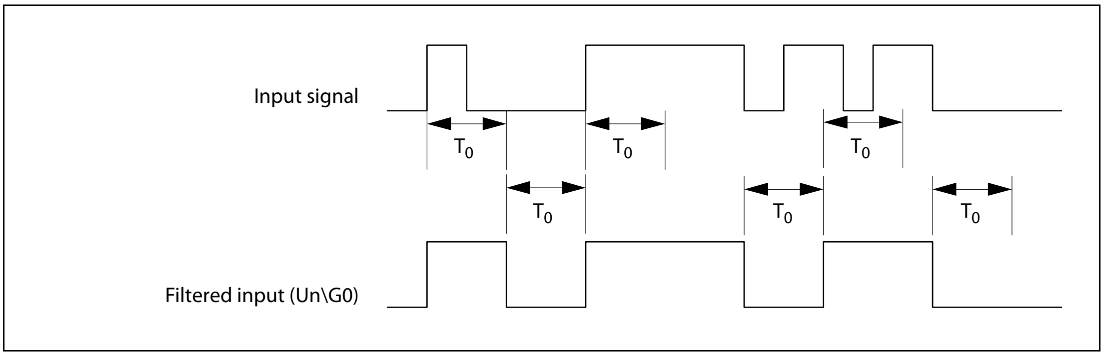


Fig. 3-6: *Pulses shorter than the time T_0 are extended*

The time for the minimum pulse length can be set for each input in the buffer memory addresses Un\G46 to Un\G61 (refer to section 3.5.13).

3.3.3 Flutter Monitoring

With flutter monitoring it is possible to detect fluttering signals which can be a hint for a defective sensor or a poorly adjusted target.

If a certain number of signal changes (Parameter n) or more are detected in a certain time (Parameter T_0), input signal Xn1 is turned ON, indicating a fault. Additionally a bit in the buffer memory is set which shows the faulty input. Both the input signal Xn1 and the buffer memory bit has to be reset by the application.

The parameter T_0 can be in the range from 0 to 60 s in increments of 500 ms . If the parameter T_0 is set to 0, the function is disabled.

The parameter n can be set in the range from 2 to 31.

NOTE The parameter n stands for the number of signal changes and not for the number of pulses. One pulse of the input signal has two signal changes (OFF to ON and ON to OFF.)

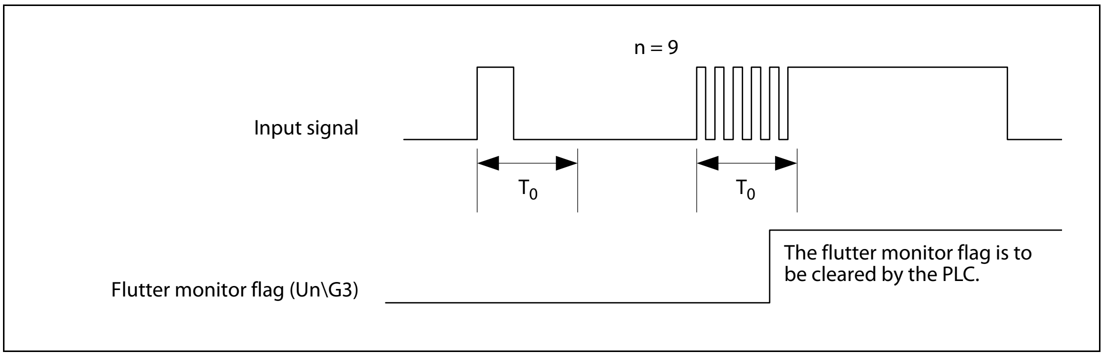


Fig. 3-7: *When n or more signal changes occur during the interval T_0, flutter is recognized*

The first interval T_0 is started when a slope is detected, the next interval T0 is started with the next slope after the previous interval T_0.

The parameters for flutter monitoring can be set for each input in the buffer memory addresses Un\G62 to Un\G77 (refer to section 3.5.14).

NOTE

If the input signal flutters for less than $2 \times T_0$ it may be not detected in some situation (refer to figure below). In order to detect short flutter signals reliably, T_0 should be as short as possible.

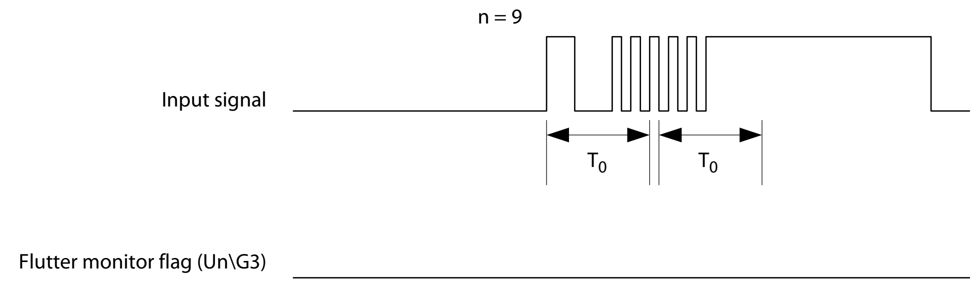


Fig. 3-8: *Short flutter signals*

3.3.4 Events

Signal changes of an input signal or errors (wire break, short circuit, flutter) can be defined as an event. In case of an event, the type of event, cause of the event etc. together with the date and time of the event is stored in an internal buffer in the ME1X16NA-Q. This buffer can store the data of up to 64 events.

The data of one event is also stored in the buffer memory of the ME1X16NA-Q, where it can be retrieved by the PLC CPU.

To indicate that there is event data in the buffer memory, a signal (Xn4) to the PLC CPU is switched ON. After reading the event data, the PLC CPU turns ON the signal "Event reset" (Yn4) to reset Xn4. If another event is pending, Xn4 turns ON again as soon as Yn4 has been turned OFF.

The internal buffer works "first in – first out". With an empty internal buffer and an empty event buffer in the buffer memory, the first event is shown in the buffer memory. Subsequent events are stored in the internal buffer. After a Xn4/Yn4 handshake, the data of the second event is moved to the buffer memory.

Please note that there is no indication of the number of events waiting in the internal buffer. In order to read the data of all events, the user has to execute the Xn4/Yn4 handshake as long as the signal Xn4 turns ON.

The events are counted in order to simplify the evaluation of their sequence.

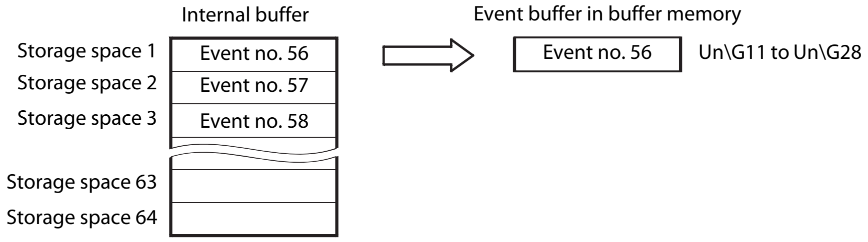


Fig. 3-9: *Example with two more events pending in the internal buffer*

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Time stamping

The event data also includes the date and time of the event (time stamp). This data is taken from the internal clock of the ME1X16NA-Q.

If the time stamp is not needed, setting of the internal clock is not required.

If the time stamp is evaluated, system wide consistent real-time clock (RTC) data is necessary. For this reason the PLC provides RTC data to the ME1X16NA-Q and the module continues its own time keeping with the internal clock.

To keep accuracy, the time shall be updated at least every minute. The procedure to set the clock of the ME1X16NA-Q is described in section 3.5.15.

There are several ways to acquire RTC data. The following should be seen as examples.

- Use of the internal clock of the PLC CPU

  The internal clock of the PLC CPU can be set by a programming tool (GX Developer, GX IEC Developer, GX Works2) or the sequence program using a DATEWR or S(P).DATEWR instruction.

  For reading the date and time out of the PLC CPU, a DATERD or S(P).DATERRD instruction can be used. The difference between these two instructions is that the S(P).DATERRD also reads the milliseconds from the clock. Since the milliseconds are required for the clock of the ME1X16NA-Q, a S(P).DATERRD should preferably be used. However, a S(P).DATERRD cannot be executed by MELSEC System Q Basic PLC CPU modules and for some of the other CPUs of the MELSEC System Q a certain function version is needed.

  When the milliseconds of the time stamp are not evaluated, also a DATERD instruction can be used.

  For a detailed description of these instructions, please refer to the programming manual for the MELSEC System Q and the L Series.

- Time synchronization via Ethernet

  The real-time clock data is transmitted to the PLC CPU via Ethernet and then stored in the ME1X16NA-Q.

- Time synchronization using SNTP (Simple Network Time Protocol)

  Using an QnUDECPU (with built-in Ethernet Port) or a MES interface module Q71MES96 the clock of the PLC CPU can be set through communications with an SNTP server computer. This enables to synchronize the time for the entire system. The clock data is then stored in the ME1X16NA-Q.

3.4 I/O Signals for the Programmable Controller CPU

3.4.1 List of I/O signals

Note that the I/O numbers (X/Y) shown in this section and thereafter depends on the mounting position resp. on the start I/O number or head address of the ME1X16NA-Q. This head address has to be added to the shown I/O numbers.

For example, if the ME1X16NA-Q occupies the range from X/Y040 to Y/X05F the head address is X/Y040. However the least significant digit is omitted and the head address "n" in this case reads as "4". The "module ready" input (Xn0) will be X40 and the "error flag" will be X4F.

NOTE

In this manual, the I/O signals of the ME1X16NA-Q for communication with the PLC CPU are designated Xn0 to Xn1F and Yn0 to Yn1F. The inputs from the NAMUR sensors are designated CH0 to CHF.

Signal direction CPU Module ⟵ ME1X16NA-Q		Signal direction CPU Module ⟶ ME1X16NA-Q	
Device No. (Input)	**Signal name**	**Device No. (Output)**	**Signal name**
Xn0	Module ready	Yn0	Use prohibited
Xn1	Flutter warning	Yn1	Flutter warning clear request
Xn2	Update real-time clock acknowledge	Yn2	Update real-time clock
Xn3	Use prohibited	Yn3	Use prohibited
Xn4	Event detection	Yn4	Event reset
Xn5	Event buffer full	Yn5	Event buffer clear request
Xn6	Use prohibited	Yn6	Use prohibited
Xn7	External 24 V ready	Yn7	
Xn8	Use prohibited	Yn8	
Xn9	Operating condition setting complete	Yn9	Operating condition setting request
XnA	Use prohibited	YnA	Use prohibited
XnB		YnB	
XnC		YnC	
XnD	Wire break detection	YnD	Wire break detection clear request
XnE	Short circuit detection	YnE	Short circuit detection clear request
XnF	Error	YnF	Error clear request
Xn10 to Xn1F	Use prohibited	Yn10 to Yn1F	Use prohibited

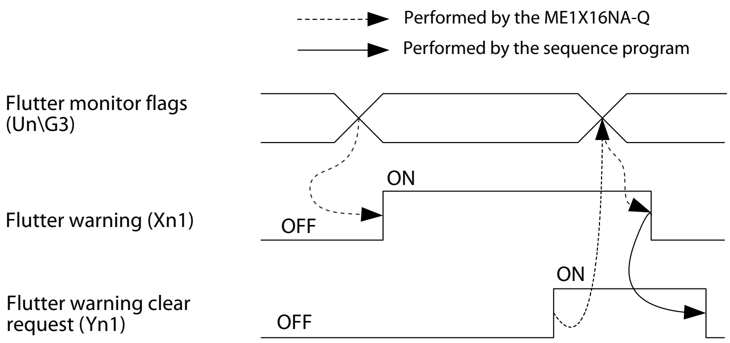
Tab. 3-5: *I/O signals of the ME1X16NA-Q*

NOTE

The "Use prohibited" signals cannot be used by the user since they are for system use only.
If these are turned ON/OFF by the sequence program, the performance of the NAMUR input module cannot be guaranteed.

3.4.2 Details of I/O signals

Input signals

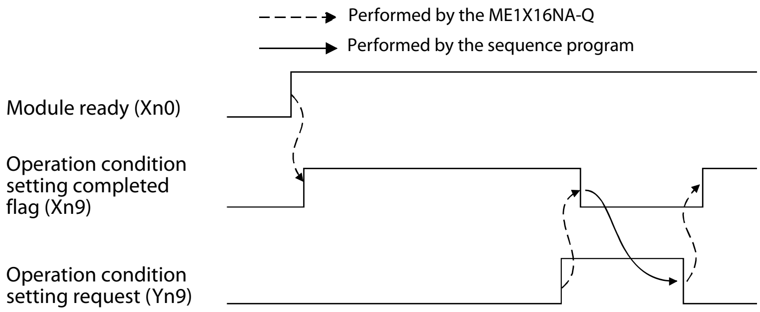
Device No.	Signal Name	Description
Xn0	Module ready	• When the programmable controller CPU is powered on or reset, this signal turns on when the preparation for module operation has been completed. • When the NAMUR input module has a watchdog timer error, "Module ready" (Xn0) turns OFF.
Xn1	Flutter warning	• The flutter warning turns ON when a flutter is detected on a least one input and therefore at least one bit of Un\G3 is set. • To switch OFF the flutter warning (Xn1) and to clear the flutter monitor flags (Un\G3), switch the flutter warning clear request (Yn1) ON. • When the flutter warning (Xn1) is OFF, switch the flutter warning clear request (Yn1) OFF. 
Xn2	Update real-time clock acknowledge	• This signal is switched ON when the signal Yn2 (update real-time clock) has been switched ON to adjust the real-time clock of the ME1X16NA-Q. • Xn2 is switched OFF after Yn2 has been switched OFF (refer to section 3.5.15).
Xn4	Event detection	• The signal Xn4 is ON when an event is pending in the event buffer (Un\G11 to Un\G28, refer to section 3.5.11). • To switch OFF Xn4, switch ON the signal Yn4 (Event reset). With the rising edge of Yn4, Xn4 turns OFF. After Xn4 has turned OFF, switch Yn4 OFF. If another event is pending, Xn4 turns ON again as soon as Yn4 has ben turned OFF. This timing is shown in section 3.5.11.
Xn5	Event buffer full	• This signal turns ON if the internal event buffer is full. • This signal turns OFF if at least one position in the internal event buffer is free.
Xn7	External 24 V ready	• This signal turns ON as soon as the external 24 V supply is available and the communication with the NAMUR input circuit is stable. • This signal turns OFF when the external 24 V are not present or the communication with the NAMUR input circuit is disturbed. • It is recommended to check this signal always before using any of the input values in the buffer memory addresses Un\G0 to Un\G3.

Tab. 3-6: *Detailed description of the input signals (Signal direction ME1X16NA-Q → CPU Module)*

<table>
<tr><th>Device No.</th><th>Signal Name</th><th>Description</th></tr>
<tr><td>Xn9</td><td>Operating condition setting completed flag</td><td>

- This signal is used as an interlock condition to turn ON/OFF the operating condition setting request (Yn9) when any of the following settings has been changed.
  - Error detection settings (buffer memory address Un\G4)
  - Event buffer enable settings (buffer memory addresses Un\G8 to Un\G10)
  - Short pulse discrimination settings (buffer memory addresses Un\G30 to Un\G45)
  - Pulse stretching settings (buffer memory addresses Un\G46 to Un\G61)
  - Flutter monitoring parameters (buffer memory addresses Un\G62 to Un\G77)
- The operating condition setting completed flag (Xn9) turns OFF when the operating condition setting request (Yn9) is ON.
- To update settings, write new values into the buffer memory while Xn9 is ON, then switch Yn9 ON.

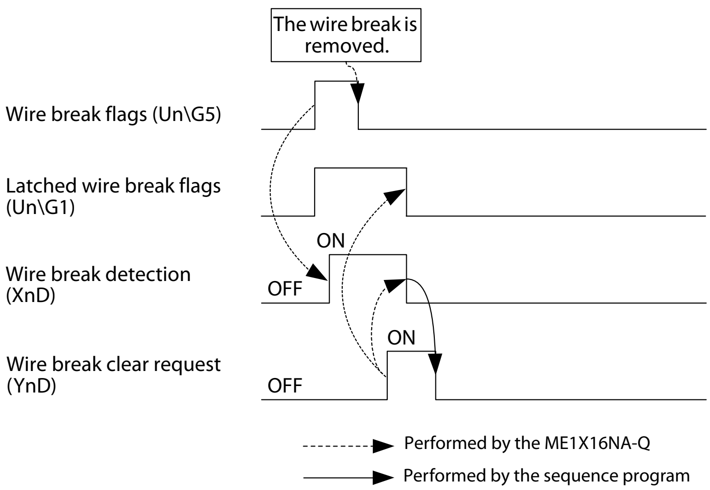
  Xn9 will be ON until new settings are stored in the module. As soon as Xn9 is OFF, switch Yn9 OFF. After completion of the update, Xn9 will be ON again.



- Among module initialization, the parameter update procedure using the Yn9/Xn9 handshake must be performed at least once to avoid using undefined operation parameters.

</td></tr>
<tr><td>XnD</td><td>Wire break detection</td><td>

- This signal turns ON if a wire break is detected on one or more input enabled for error detection (the according bit in Un\G4 is set, please refer to section 3.5.6).
- To switch OFF this signal, replace the faulty sensor(s) or deactivate the error detection for the faulty channel(s) and then switch the wire break detection clear request (YnD) ON.
- When XnD is OFF, switch YnD OFF.

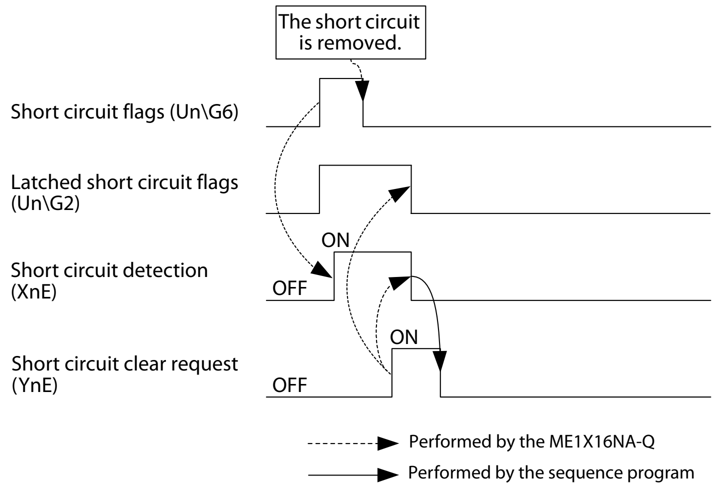


</td></tr>
</table>

Tab. 3-6: *Detailed description of the input signals (Signal direction ME1X16NA-Q ⟶ CPU Module)*

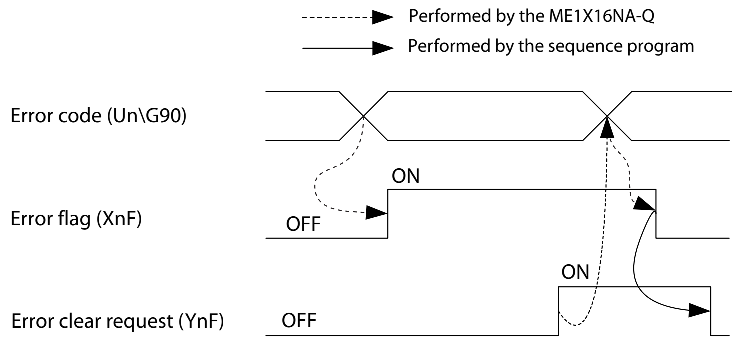
<table>
<tr><th>Device No.</th><th>Signal Name</th><th>Description</th></tr>
<tr><td>XnE</td><td>Short circuit detection</td><td>

- This signal turns ON if a short circuit is detected on one or more inputs enabled for error detection (the according bit in Un\G4 is set, please refer to section 3.5.6).
- To switch OFF this signal, replace the faulty sensor(s) or deactivate the error detection for the faulty channel(s) and then switch the short circuit detection clear request (YnE) ON.
- When XnE is OFF, switch YnE OFF.



</td></tr>
<tr><td>XnF</td><td>Error flag</td><td>

- The error flag turns ON when an error occurs. The error code is stored in buffer memory address Un\G90.
- To turn the error flag (XnF) OFF, remove the cause of the error and set the error clear request (YnF) to ON.
- When the error flag (XnF) is OFF, set the error clear request (YnF) to OFF.



</td></tr>
</table>

Tab. 3-6: *Detailed description of the input signals (Signal direction ME1X16NA-Q → CPU Module)*

Output signals

Device No.	Signal Name	Description
Yn1	Flutter warning clear request	• Turn ON this signal to clear a flutter warning. • For the ON/OFF timing, please refer to the entry for input Xn1 in table 3-6.
Yn2	Update real-time clock	• Turn ON this signal after writing the clock data into the real-time clock setting register (Un\G80 to Un\G87). • Wait until Xn2 is switched ON. • Switch OFF Yn2. Please refer to section 3.5.15 for a detailed description of the update sequence.
Yn4	Event reset	• This signal controls the reading process of the event buffer. • For the ON/OFF timing, please refer to the entry for input Xn4 in table 3-6.
Yn5	Event buffer clear request	• Turn this signal ON while there are any recorded events pending (Xn4 (Event) is ON.) to clear the internal event buffer. • After the event buffer is cleared (Xn4 and in case of a full event buffer also Xn5 is switched OFF), switch this signal back to OFF.
Yn9	Operating condition setting request	• Turn ON this signal when changing any of the following settings to make the settings valid. – Error detection settings (buffer memory address Un\G4) – Event buffer enable settings (buffer memory addresses Un\G8 to Un\G10) – Short pulse discrimination settings (buffer memory addresses Un\G30 to Un\G45) – Pulse stretching settings (buffer memory addresses Un\G46 to Un\G61) – Flutter monitoring parameters (buffer memory addresses Un\G62 to Un\G77) • For the ON/OFF timing, please refer to the entry for input Xn9 in table 3-6.
YnD	Wire break detection clear request	• Turn this signal ON to clear a wire break error. • For the ON/OFF timing, please refer to the entry for input XnD in table 3-6.
YnE	Short circuit detection clear request	• Turn this signal ON to clear a short circuit error. • For the ON/OFF timing, please refer to the entry for input XnE in table 3-6.
YnF	Error clear request	• Turn this signal ON to clear an error. • For the ON/OFF timing, please refer to the entry for input XnF in table 3-6.

Tab. 3-7: *Detailed description of the output signals (Signal direction CPU Module → ME1X16NA-Q)*

3.5 Buffer Memory

The NAMUR input module has a memory range assigned as a buffer for temporary storage of data, such as input values or wire break flags. The PLC CPU can access this buffer and both read the stored values from it and write new values to it which the module can then process (settings for the module's functions such as short pulse discrimination times, flutter monitoring parameters, etc.).

Each buffer memory address consists of 16 bits.

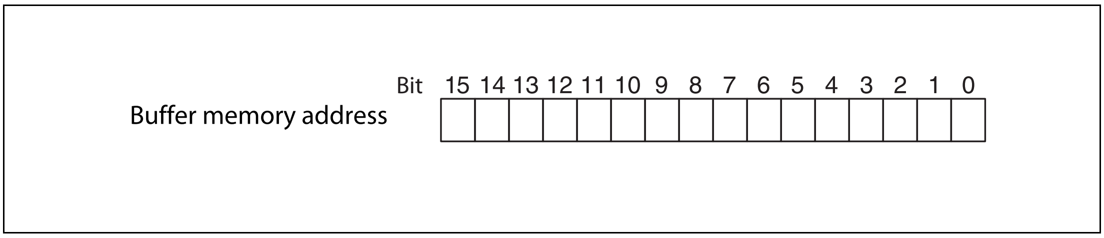


Fig. 3-10: *Assignments of bits to a buffer memory address*

NOTE

Do not write data in the "system areas" of the buffer memory. If data is written to any of the system areas, the PLC system may not be operated properly. Some of the user areas contain partially system areas. Care must be taken when reading/writing to the buffer memory.
Also, do not write data (e.g. in a sequence program) to the buffer memory area where writing is disabled. Doing so may cause malfunction.

The "Default" value indicated in the following tables is the initial value set after the power is turned on or the PLC CPU is reset.

Instructions for data exchange with the buffer memory

Communication between the PLC CPU and the buffer memory of special function modules is performed with FROM and TO instructions.

The buffer memory of a special function module can also accessed directly, e. g. with a MOV instruction. The special function module addressed in this way can be mounted on a base unit or an extension base unit but not in remote I/O stations.

Format of the device address: Un\Gn

– Un: Head address of the special function module
– Gn: Buffer memory address (decimal)

For example the device address U3\G11designates the buffer memory address 11 in the special function module with the head address 3 (X/Y30 to X/Y3F).

In this User's Manual the latter form of addressing is used throughout.

For full documentation of all the instructions with examples please refer to the Programming Manual for the MELSEC System Q and the L series.

3.5.1 Buffer Memory Assignment

Address: Hexa-decimal	Address: Decimal	Description			Default	R/W*	Reference (Section)
0H	0	Filtered input values			0000H	R	3.5.2
1H	1	Wire break flags (Latched)			0000H	R	3.5.3
2H	2	Short circuit flags (Latched)			0000H	R	3.5.4
3H	3	Flutter monitor flags			0000H	R	3.5.5
4H	4	Error detection settings			0000H	R/W	3.5.6
5H	5	Wire break flags			0000H	R	3.5.7
6H	6	Short circuit flags			0000H	R	3.5.8
7H	7	System area			—	—	—
8H	8	Event buffer enable flags	Positive edge (Input Un\G0)		0000H	R/W	3.5.9
9H	9		Negative edge (Input Un\G0)		0000H		
AH	10		Errors (Flutter monitor Un\G3, Wire break Un\G5, Short circuit Un\G6)		0000H		3.5.10
BH	11	Event buffer	Status		0000H	R	3.5.11
CH	12		Event ID (Free Running Event Counter)				
DH	13		Time-stamp	Year			
EH	14			Month			
FH	15			Day			
10H	16			Hour			
11H	17			Minute			
12H	18			Second			
13H	19			Day of the week			
14H	20			Milliseconds			
15H	21		Event information	Input number			
16H	22			Event code			
17H	23		Detailed buffer memory log	Input trigger			
18H	24			Filtered input values before trigger			
19H	25			Filtered input values after trigger			
1AH	26			Current wire break flags after trigger			
1BH	27			Current short circuit flags after trigger			
1CH	28			Flutter monitor flags after trigger			
1DH	29	System area			—	—	—
1EH	30	Input 0 (CH0)	Short pulse discrimination time		0000H	R/W	3.5.12
1FH	31	Input 1 (CH1)					
20H	32	Input 2 (CH2)					
21H	33	Input 3 (CH3)					
22H	34	Input 4 (CH4)					
23H	35	Input 5 (CH5)					
24H	36	Input 6 (CH6)					
25H	37	Input 7 (CH7)					
26H	38	Input 8 (CH8)					
27H	39	Input 9 (CH9)					
28H	40	Input 10 (CHA)					
29H	41	Input 11 (CHB)					
2AH	42	Input 12 (CHC)					
2BH	43	Input 13 (CHD)					
2CH	44	Input 14 (CHE)					
2DH	45	Input 15 (CHF)					

Tab. 3-8: *Buffer memory assignment of the ME1X16NA-Q*

Address		Description		Default	R/W*	Reference (Section)
Hexa-decimal	Decimal					
2EH	46	Input 0 (CH0)	Pulse stretching time	0000H	R/W	3.5.13
2FH	47	Input 1 (CH1)				
30H	48	Input 2 (CH2)				
31H	49	Input 3 (CH3)				
32H	50	Input 4 (CH4)				
33H	51	Input 5 (CH5)				
34H	52	Input 6 (CH6)				
35H	53	Input 7 (CH7)				
36H	54	Input 8 (CH8)				
37H	55	Input 9 (CH9)				
38H	56	Input 10 (CHA)				
39H	57	Input 11 (CHB)				
3AH	58	Input 12 (CHC)				
3BH	59	Input 13 (CHD)				
3CH	60	Input 14 (CHE)				
3DH	61	Input 15 (CHF)				
3EH	62	Input 0 (CH0)	Flutter monitoring parameters	0000H	R/W	3.5.14
3FH	63	Input 1 (CH1)				
40H	64	Input 2 (CH2)				
41H	65	Input 3 (CH3)				
42H	66	Input 4 (CH4)				
43H	67	Input 5 (CH5)				
44H	68	Input 6 (CH6)				
45H	69	Input 7 (CH7)				
46H	70	Input 8 (CH8)				
47H	71	Input 9 (CH9)				
48H	72	Input 10 (CHA)				
49H	73	Input 11 (CHB)				
4AH	74	Input 12 (CHC)				
4BH	75	Input 13 (CHD)				
4CH	76	Input 14 (CHE)				
4DH	77	Input 15 (CHF)				
4EH	78	System area		—	—	—
4FH	79					
50H	80	Real-time clock setting	Year	0000H	R/W	3.5.15
51H	81		Month			
52H	82		Day			
53H	83		Hour			
54H	84		Minute			
55H	85		Second			
56H	86		Day of the week			
57H	87		Millisecond			
58H	88	System area		—	—	—
59H	89					
5AH	90	Error Code		0000H	R/W	3.5.16
5BH	91	System area		—	—	—
	to					
7FFFH	32767					

Tab. 3-8: *Buffer memory assignment of the ME1X16NA-Q*

* Indicates whether reading from and writing to a sequence program are enabled.
R : Read enabled
W : Write enabled

3.5.2 Filtered Input Values (Un\G0)

When after all filtering an input signal is "1", the respective bit in the buffer memory address Un\G0 is set to 1.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G0	CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

0: Input is OFF
1: Input is ON

Fig. 3-11: *Assignment of the bits in buffer memory address 0*

Example ▽

When the inputs CHC, CH6, CH1 and CH0 have a "1"-input signal, 1043H (4163) is stored into buffer memory address 0 (Un\G0).

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	1	1043H
CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
1				0				4				3				

Fig. 3-12: *In this example the inputs CHC, CH6, CH1 and CH0 are switched ON*

△

3.5.3 Latched Wire Break Flags (Un\G1)

- When a wire break is detected for an input activated for error detection, the respective bit in the buffer memory address Un\G1 is set to 1.
- When the wire break condition is gone, the bit will remain set until completion of the wire break detection clear request process using XnD/YnD signals.
- The respective bit in Un\G0 (filtered input value) is set to 0 as long as the input is within wire break condition.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G1	CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

0: Normal
1: Wire break

Fig. 3-13: *Assignment of the bits in buffer memory address 1*

Example ▽ When there is a wire break on CH8, 0100H (256) is stored into buffer memory address 1 (Un\G1).

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0100H
CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
0				1				0				0				

Fig. 3-14: *In this example a broken wire is detected for input CH8*

△

3.5.4 Latched Short Circuit Flags (Un\G2)

- When a short circuit is detected for an input activated for error detection, the respective bit in the buffer memory address Un\G2 is set to 1.
- When the short circuit condition is gone, the bit will remain set until completion of the short circuit detection clear request process using XnE/YnE signals.
- The respective bit in Un\G0 (filtered input value) is set to 0 as long as the input is within short circuit condition.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G2	CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

0: Normal
1: Short circuit

Fig. 3-15: *Assignment of the bits in buffer memory address 2*

Example ▽ When there is a short circuit on CHA, 0400H (1024) is stored into buffer memory address 2 (Un\G2).

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0400H
CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
0				4				0				0				

Fig. 3-16: *In this example a short circuit is detected for input CHA*

△

3.5.5 Flutter Monitor Flags (Un\G3)

- When fluttering is detected for an input with activated flutter monitoring function, the respective bit in the buffer memory address Un\G3 is set to 1.
- For information how to activate the flutter monitoring function for a certain input, please refer to section 3.3.3.
- When at least one flutter monitoring flag in Un\G3 is 1, the signal Xn1 is switched ON (section 3.4.)
- The flags are reset by the signal Yn1 (Flutter warning clear request) only.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G3	CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

0: Normal
1: Flutter

Fig. 3-17: *Assignment of the bits in buffer memory address 3*

Example ▽ When input CH5 shows fluttering, 0020H (32) is stored into the buffer memory address 3 (Un\G3).

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0020H
CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
0				0				2				0				

Fig. 3-18: *In this example flutter is detected for input CH5*

△

3.5.6 Error Detection Settings (Un\G4)

- To enable wire break and short circuit detection for a certain input, set the according bit in Un\G4 to 1.
- Any changes will not take effect until the new value is committed by using the Yn9/Xn9 handshake procedure (refer to section 3.4.2).
- An input not activated for error detection will not have its wire break or short circuit bit set in case of an error (but the respective input value bit will still be set to 0 during error condition) nor will it influence the Signals XnD and XnE.
- This is to avoid continuous error detection if not all 16 NAMUR channels are used. It is recommended to enable error detection for each used NAMUR channel.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G4	CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

0: Error detection disabled
1: Error detection enabled

Fig. 3-19: *Assignment of the bits in buffer memory address 4*

Example ▽

To enable error detection for NAMUR channels 0 to 5, store 003FH (63) in the buffer memory address 4 (Un\G4)

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	003FH
CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
0				0				3				F				

Fig. 3-20: *In this example error detection is enabled for the inputs CH0 to CH5*

△

3.5.7 Wire Break Flags (Un\G5)

- As long as an input enabled for error detection is in a wire break condition, the respective bit in the buffer memory address Un\G5 is set to 1.
- When the NAMUR input circuit detects that the wire break condition is gone, the respective bit will be reset to 0. No wire break detection clear request process using YnD/XnD signals is required.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G5	CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

0: Normal
1: Wire break

Fig. 3-21: *Assignment of the bits in buffer memory address 5*

Example ▽ As long as the inputs CH0 to CH5 are enabled for error detection and when there is a wire break on the inputs CH1 and CH4, the value 0012_H (18) is stored in the buffer memory address 5 (Un\G5).

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0012_H
CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
0				0				1				2				

Fig. 3-22: *In this example a broken wire is detected for the inputs CH1 and CH4.*

△

3.5.8 Short Circuit Flags (Un\G6)

- As long as an input enabled for error detection is in a short circuit condition, the respective bit in the buffer memory address Un\G6 is set to 1.
- When the NAMUR input circuit detects that the short circuit condition is gone, the respective flags will be reset to 0. No short circuit detection clear request process using XnE/YnE signals is required.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G6	CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

0: Normal
1: Short circuit

Fig. 3-23: *Assignment of the bits in buffer memory address 6*

Example ▽ As long as the inputs CH0 to CH5 are enabled for error detection and when there is a short circuit on input CH3, 0008H (8) is stored into buffer memory address 6 (Un\G6).

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0008H
CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
0				0				0				8				

Fig. 3-24: In this example a short circuit is detected for input CH3

△

3.5.9 Event Buffer Enable Settings (Positive Edge (Un\G8), negative Edge (Un\G9))

- The inputs in Un\G0 can trigger an event in the moment they are switched ON or OFF. This is enabled in the buffer memory addresses 8 (Un\G8) and 9 (Un\G9).
- To trigger an event when the respective input is switched ON, enable the event in Un\G8 (positive edge).
- If you want to trigger an event when the respective input is switched OFF, enable the event in Un\G9 (negative edge).
- Any changes in Un\G8 and Un\G9 will not take effect until the new value is committed by using the Yn9/Xn9 handshake procedure (refer to section 3.4.2).

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G8 Un\G9	CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

0: Event disabled
1: Event enabled

Fig. 3-25: Assignment of the bits in the buffer memory addresses 8 and 9

Example ▽ A positive edge on Input CH0 or CH5 (Un\G0.0 or Un\G0.5) triggers an event if 0021H (33) is stored into the buffer memory address 8 (Un\G8).

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0021H
CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
0				0				2				1				

Fig. 3-26: An event is triggered when the input CH0 or the input CH5 is switched ON

△

Example ▽ If 0022H (34) is stored into the buffer memory address 9 (Un\G9), a negative edge on Input CH1 or CH5 triggers an event.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0022H
CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
0				0				2				2				

Fig. 3-27: *An event is triggered when either of the inputs CH1 or CH5 is switched OFF*

△

3.5.10 Event Buffer Enable Settings (Errors) (Un\G10)

- A wire break, short circuit or signal fluttering error (positive edge in Un\G5, Un\G6 or Un\G3) on the selected inputs in Un\G10 will trigger an event.

NOTE Each signal flutter error will generate a new error event even if the Flutter Monitor Flags in Un\G3 are not cleared.

- Any changes in Un\G10 will not take effect until the new value is committed by using the Yn9/ Xn9 handshake procedure (refer to section 3.4.2).

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Un\G10	CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0

0: Event disabled
1: Event enabled

Fig. 3-28: *Assignment of the bits in the buffer memory address 10*

Example ▽ An error on input CH0, CH1 or CH5 triggers an event if 0023H (35) is stored into the buffer memory address 10 (Un\G10).

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0023H
CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
0				0				2				3				

Fig. 3-29: *An event is triggered when an error is detected for one of the inputs CH0, CH1 or CH5*

△

3.5.11 Event Buffer (Un\G11 to Un\G28)

The event buffer logs the changes of the inputs and respective errors. By evaluating the event buffer, it is possible to track sequences of switching events.

- Only those inputs enabled in the Event Buffer Enable Settings (Un\G8, Un\G9 and Un\G10) can trigger an event.
- The module has an internal buffer for 64 events. The sequence program has to read out the events to empty the internal buffer.
- If the internal event buffer is full, new events will not be recorded.
- The event buffer works "first in – first out".

Status (Un\G11)

In the buffer memory address Un\G11 the status of an event record is stored.

Status	Meaning
0000H	Valid event
0011H	First recorded event since the real-time clock was adjusted within the last second.
Other	Not used

Tab. 3-9: *Status codes in Un\G11*

Event ID (Free Running Event Counter) (Un\G12)

The event counter is incremented with every event, even if the event buffer is full and the event can not be recorded. This allows to detect missed events in case the event buffer is full.

Time-stamp (Un\G13 to Un\G20)

The time-stamp indicates the date and time the event has happened. The clock data is read from the internal clock of the ME1X16NA-Q and stored in binary format in the buffer memory addresses listed below:

Un\G13: Year	(1980 to 2079, The "Year" is stored as four-digit indication.)
Un\G14: Month	(1 to 12)
Un\G15: Day	(1 to 31)
Un\G16: Hour	(24-hour clock, 0 to 23)
Un\G17: Minute	(0 to 59)
Un\G18: Second	(0 to 59)
Un\G19: Day of the week	(0 to 6, 0: Sunday, 1: Monday, 2: Tuesday ... 6: Saturday)
Un\G20: Milliseconds	(0 to 999)

The format, the order of data and the data ranges are identical to the S(P).DATERD instruction.

Example ▽ If an event was triggered on Monday, 24th December 2012 at 10:57:39 and 530 ms.

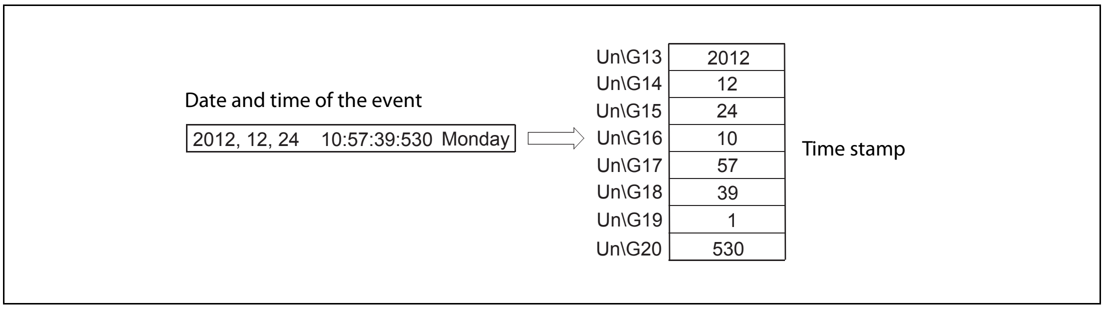


Fig. 3-30: *Storage of date and time*

△

Input number (Un\G21), input trigger (Un\G23)

The input trigger register shows which input triggered the event. When several inputs generate an event within 1 ms, a separate event is stored in the event buffer for each input, starting with input 0. Those events have the same time stamp.*

In addition, the input number register (Un\G21) shows the decimal number of the input that triggered the event.

* If for example both inputs CH5 and CH0 trigger an event within 1 ms, separate events are generated for CH0 first and then CH5 with the same time stamp.

Example ▽ If 0020H (32) is stored in the input trigger register (Un\G23), input CH5 has triggered the event.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0020H
CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
0				0				2				0				

Fig. 3-31: *The contents of Un\G23 indicates that the event was triggered by input CH5*

In addition, the decimal channel number 5 will be stored in the input number register (Un\G21).

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0005H
CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
0				0				0				5				

Fig. 3-32: *Un\G21 shows the number of the input*

△

Event code (Un\G22)

The event code shows the type of event recorded for the input.

Event code	Type of event
F001H	Wire break
F002H	Short circuit
F004H	Signal flutter
F008H	Positive edge
F00CH	Combined positive edge and signal flutter
F010H	Negative edge
F011H	Combined negative edge and wire break
F012H	Combined negative edge and short circuit
F014H	Combined negative edge and signal flutter
Other	Not used

Tab. 3-10: *Event codes in buffer memory address Un\G22*

Sequence to read out the event buffer

① Make sure the signal Yn4 (Reset event) is OFF and wait until the signal Xn4 (Event) is switched ON.

② Read out the event buffer (Un\G11 to Un\G28).

③ Switch Yn4 (Reset event) ON and wait until the signal Xn4 (Event) is switched OFF.

④ Switch Yn4 (Reset event) OFF.

⑤ Continue with Step ①.

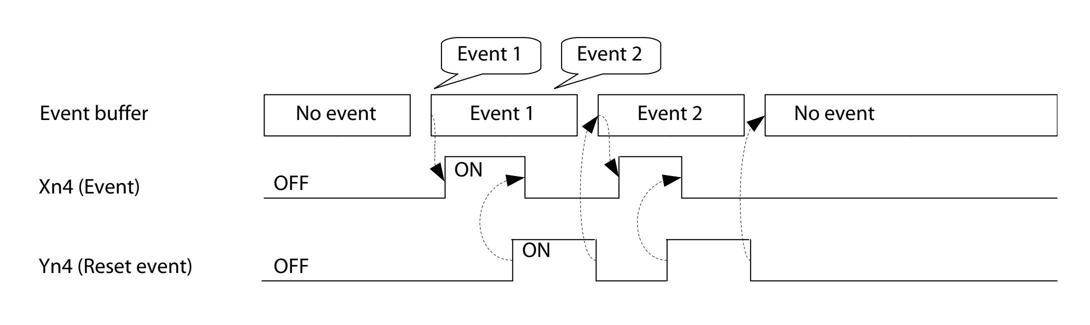


Fig. 3-33: *Reading of the event buffer*

3.5.12 Short Pulse Discrimination Time CH□ (Un\G30 to Un\G45)

- For each input of the module a buffer memory address to adjust the short pulse discrimination time (section 3.3.1) is provided.
- The time can be adjusted from 0 to 2 s in 5 ms steps.
  Set time = Set value × 5 ms (setting range 0 to 400)
  For example, the set value 400 (190H) means 400 × 5 ms = 2000 ms = 2 s
- If the set value is outside the allowed range, an error will occur.
- If the time is set to 0, the function is disabled for the respective input.
- Any changes in the area Un\G30 to Un\G45 will not take effect until the new value is committed by using the Yn9/Xn9 handshake procedure (refer to section 3.4.2)

Example ▽ To set input CH3 to a short pulse discrimination time of 500 ms, 64H (100) is written into Un\G33.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0064H
CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0	
0				0				6				4				

Fig. 3-34: *Setting of a short pulse discrimination time of 500 ms in Un\G33 for input CH3*

△

3.5.13 Pulse Stretching Time CH□ (Un\G46 to Un\G61)

- The pulse stretching time (section 3.3.2) of each input can be adjusted in the buffer memory.
- The time can be adjusted from 0 to 2 s in 100 ms steps.
  Set time = Set value × 100 ms (setting range 0 to 20)
  For example, the set value 20 (14H) means 20 × 100 ms = 2000 ms = 2 s
- If the set value is outside the allowed range, an error will occur.
- If the time is set to 0, the function is disabled for the respective input.
- Any changes in the area Un\G46 to Un\G61 will not take effect until the new value is committed by using the Yn9/Xn9 handshake procedure (refer to section 3.4.2).

Example ▽ To set input CH3 to a pulse stretching time of 500 ms, 5H (5) is written into Un\G49.

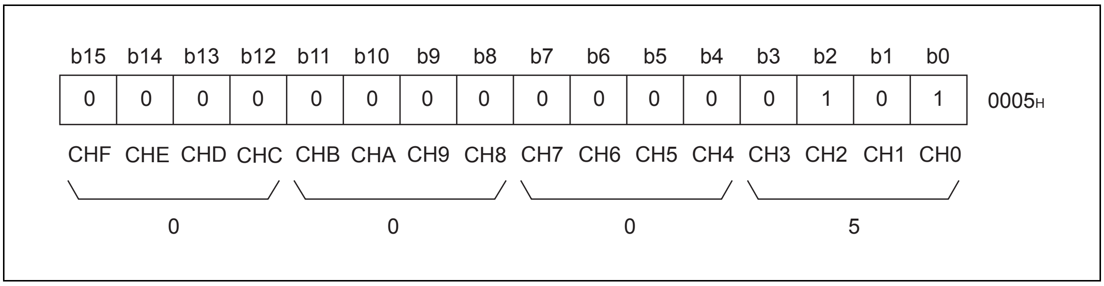


Fig. 3-35: *Setting of a pulse stretching time of 500 ms in Un\G49 for input CH3*

△

3.5.14 Flutter Monitoring Parameters CH□ (Un\G62 to Un\G77)

- Using flutter monitoring it is possible to detect fluttering signals (refer to section 3.3.3).
- For each input of the module, the time of the flutter monitoring window and the maximum allowed number of signal changes can be set in the buffer memory.

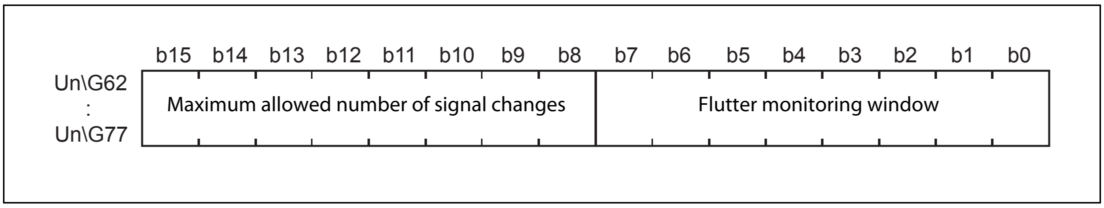


Fig. 3-36: *Assignment of the buffer memory addresses 62 to 77*

- The window time can be adjusted from 0 to 60 s in 500 ms steps.
  Set time = Set value × 500 ms (setting range 0 to 120)
  For example, the set value 120 (79H) means 120 × 500 ms = 60000 ms = 60 s
- The setting range for the maximum allowed number of signal changes is 2 to 31.
- If any value outside the setting range is set, an error occurs and the corresponding error code is stored in buffer memory address Un\G90.
- If the window time is set 0, the function is disabled for the respective input.
- Any changes in the buffer memory addresses Un\G62 to Un\G77 will not take effect until the new value is committed by using the Yn9/Xn9 handshake procedure (refer to section 3.4.2).

Example ▽ To set input CH4 to a 10 s window and a maximum of 6 signal changes, 0614H (5126) is written into Un\G66. (The set value for a flutter monitoring window of 10 s is 20 (14H).)

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	
0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0614H
Maximum allowed number of signal changes								Flutter monitoring window								
0				6				1				4				

Fig. 3-37: *The flutter monitoring parameters for input CH4 are set in Un\G66*

△

3.5.15 Real-Time Clock Setting (Un\G80 to Un\G87)

- Data for setting the internal clock of the ME1X16NA-Q is stored in the buffer memory addresses Un\G80 to Un\G87.
- To keep accuracy, the time shall be updated at least every minute.
- For best accuracy, make sure to run the following process as fast as possible with no additional delays (I/Os normally are refreshed by the execution of the END instruction. In order to avoid delays caused by the cycle time, specify direct access I/Os (DXn2, DYn2).)
- The procedure to set the RTC data of the module is as follows:

  ① Make sure the signal Yn2 (Update real-time clock) is OFF.

  ② Get the clock data.

  When using the internal clock of the PLC CPU, execute a S(P).DATERD instruction to read the clock data out of the PLC CPU (Please note that the S(P).DATERD instruction reads the data including the milliseconds whereas the DATERD instruction does not read the milliseconds.)

  ③ Move the clock data into Un\G80 to Un\G87 (Copy the result of the S(P).DATERD instruction into these buffer memory addresses.)

  ④ Switch the signal Yn2 (Update real-time clock) ON.

  ⑤ Wait Xn2 (Update real-time clock acknowledge) to become ON.

  ⑥ Switch the signal Yn2 (Update real-time clock) OFF.

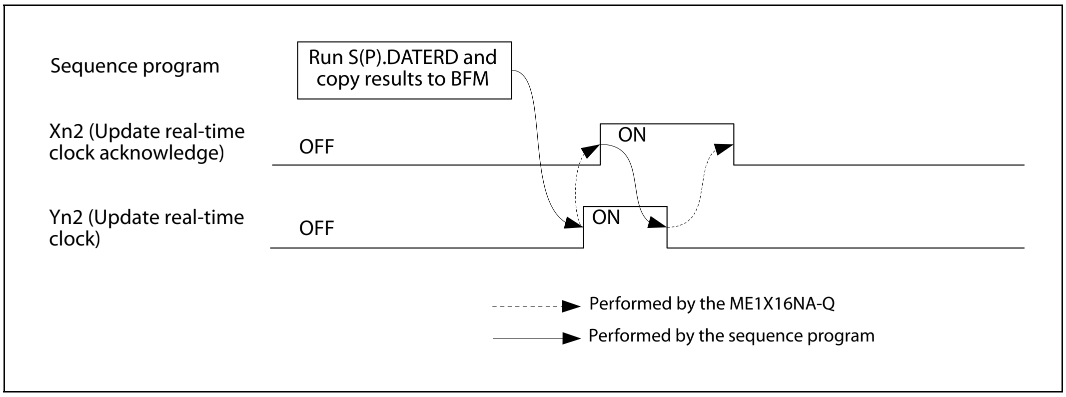


Fig. 3-38: *Updating of the real time clock*

- After the RTC has been updated, the first event within one second after the update will have its event status set to 0011H to indicate that the RTC has been adjusted.
- The data in the buffer memory addresses Un\G80 to Un\G87 has the same format as delivered by the S(P).DATERD instruction:

Un\G80: Year	(1980 to 2079)
Un\G81: Month	(1 to 12)
Un\G82: Day	(1 to 31)
Un\G83: Hour	(24-hour clock, 0 to 23)
Un\G84: Minute	(0 to 59)
Un\G85: Second	(0 to 59)
Un\G86: Day of the week	(0 to 6, 0: Sunday, 1: Monday, 2: Tuesday ... 6: Saturday)
Un\G87: Milliseconds	(0 to 999)

Example ▽ The clock is set to Friday, 19th October 2012; 09:48:14 and 257 ms.

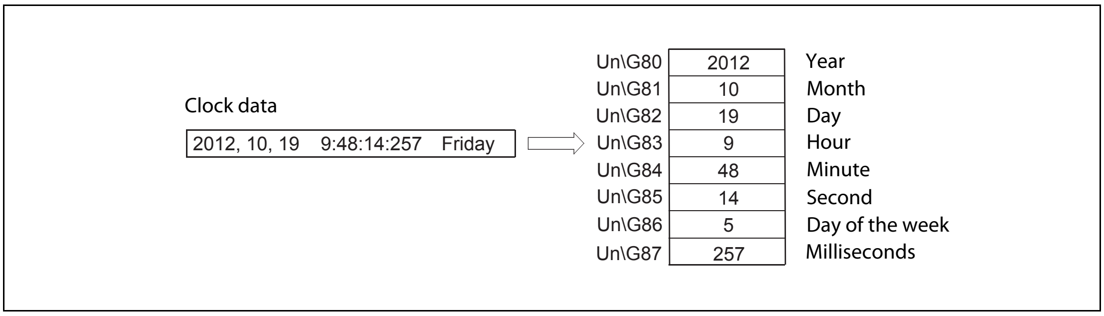


Fig. 3-39: *Storage of date and time*

△

3.5.16 Error Code (Un\G90)

- If an error occurs (In this case the signal XnF is ON), the error code is stored in the buffer memory address Un\G90.
- For more details of the error codes, please refer to section 6.1. Errors can be caused e.g. by the values in Un\G30 to Un\G77.
- If two or more errors have occurred, the latest error found by the module is stored.
- The error code can be cleared by turning ON the error clear request (YnF).

Example ▽ If the value in Un\G33 is set to 401 (allowed is a maximum of 400) and the Yn9/Xn9 handshake is performed, an error will occur. The error code 33 (21H) is stored in Un\G90.

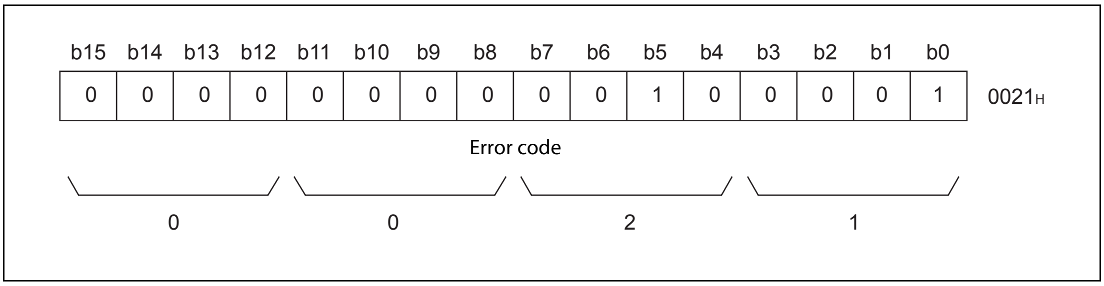


Fig. 3-40: *The error code 33 means that the setting in the buffer memory address Un\G33 is not correct*

△

4 Setup and Procedures before Operation

4.1 Handling Precautions

- Do not drop the module or subject it to heavy impact.
- Do not remove the PCB of the module from its case. Doing so may cause the module to fail.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- Before handling the module, touch a grounded metal object to discharge the static electricity from the human body.

  Failure to do so may cause the module to fail or malfunction.
- Tighten the module fixing screw within the following range. A loose screw may cause short circuits, failures, or malfunctions.

Screw location	Tightening torque range
Module fixing screw (M3 screw, optional)	0.36 to 0.48 Nm

Tab. 4-1: *Tightening torque*

- To mount the module on the base unit, fully insert the module fixing latch into the fixing hole in the base unit and press the module using the hole as a fulcrum.

  Improper installation may result in a module malfunction, or may cause the module to fall off.

4.2 Setup and Procedures before Operation

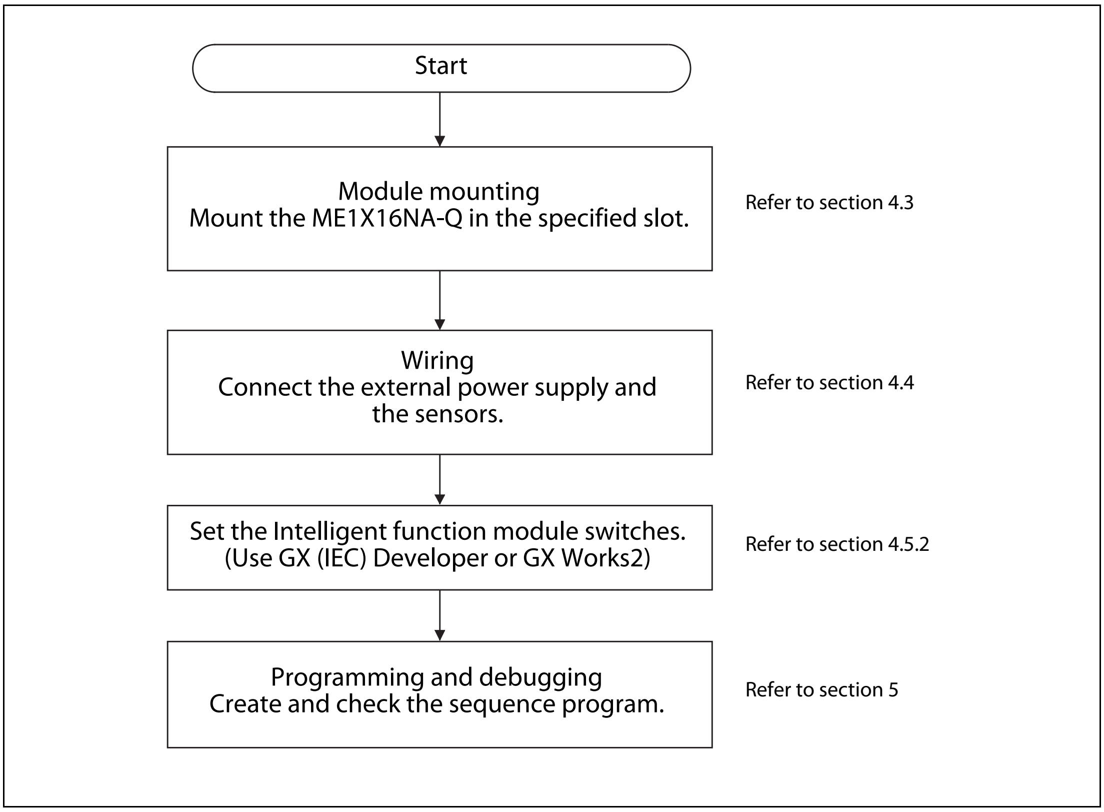


Fig. 4-1: *Function chart for the setup of the NAMUR input module*

4.3 Installation of the Module

The ME1X16NA-Q can be combined with a CPU module or, when mounted to a remote I/O station, with a master module for MELSECNET/H (refer to section 2.1).

CAUTION:

- ***Cut off all phases of the power source externally before starting the installation or wiring work.***
- ***Always insert the module fixing latch of the module into the module fixing hole of the base unit. Forcing the hook into the hole will damage the module connector and module.***
- ***Do not touch the conductive parts of the module directly.***

① After switching of the power supply, insert the module fixing latch into the module fixing hole of the base unit.

② Push the module in the direction of the arrow to load it into the base unit.

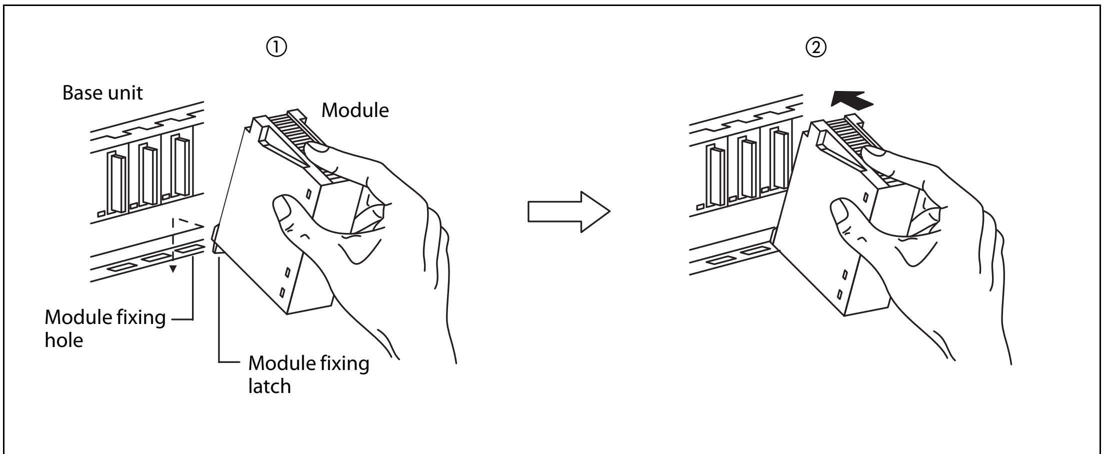


Fig. 4-2: *Module installation*

③ Secure the module with an additional screw (M3 × 12) to the base unit if large vibration is expected. This screw is not supplied with the module.

4.4 Wiring

4.4.1 Wiring Precautions

Please observe the following precautions for external wiring:

- Always confirm the terminal layout before connecting the wires to the ME1X16NA-Q.

  (For the signal layout of the connector please refer to section 3.1.1)
- Correctly solder the external wiring connector. An incomplete soldering could lead to malfunctioning.
- Make sure that foreign matter such as cutting chips and wire scraps does not enter the ME1X16NA-Q. Failure to observe this could lead to fires, faults or malfunctioning.
- A protective label is attached on the top of the ME1X16NA-Q to avoid foreign matter such as wire scraps from entering inside during wiring process. Do not remove the label until the wiring is completed. Before starting the system, however, be sure to remove the label to ensure heat radiation.
- Securely mount the external device connector to the connector on the ME1X16NA-Q with two screws.
- Do not disconnect the external wiring cable connected to the ME1X16NA-Q by pulling the cable section. When the cable has a connector, be sure to hold the connector connected to the ME1X16NA-Q. Pulling the cable while it is connected to the ME1X16NA-Q may lead to malfunctioning or damage of the ME1X16NA-Q or cable.
- Do not bundle or adjacently lay the connection cable connected to the ME1X16NA-Q external I/O signals with the main circuit line, power line, or the load line other than that for the PLC. Separate these by 100 mm as a guide. Failure to observe this could lead to malfunctioning caused by noise, surge, or induction.
- If the shielded cable is not secure, unevenness or movement of the shielded cable or careless pulling on it could result in damage to the ME1X16NA-Q or shielded cable or defective cable connections could cause misoperation of the unit.
- If the cable connected to the ME1X16NA-Q and the power line must be adjacently laid (less than 100 mm), use a shielded cable. Ground the shield of the cable securely to the control panel on the ME1X16NA-Q side. (A wiring example is given below.)
  – Wiring example of shielded cable.

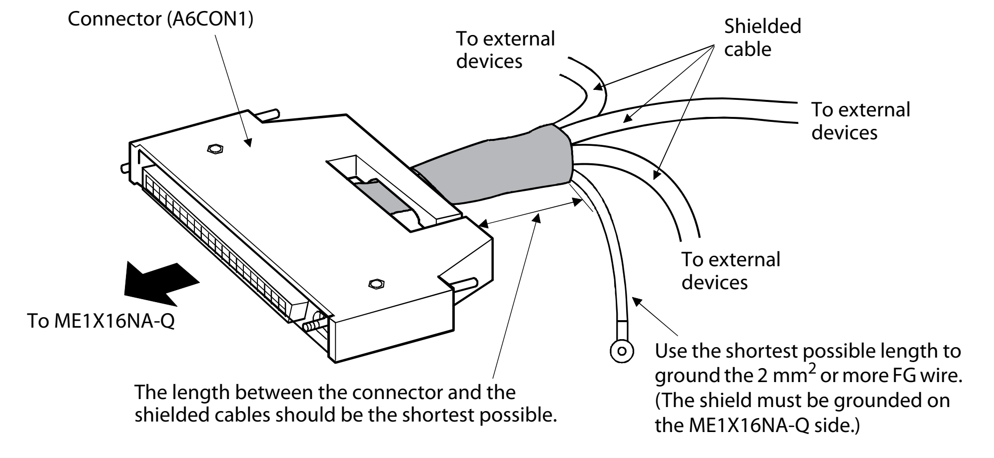


Fig. 4-3: Wiring example for noise reduction (in this case a connector A6CON1 is used)

Preparation of the connector

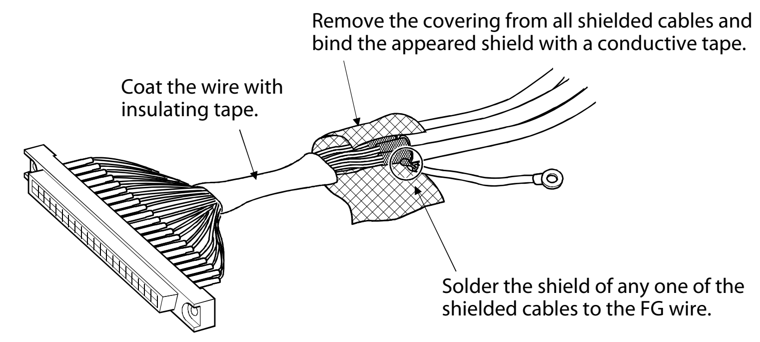


Fig. 4-4: Connection of a FG wire to each shielded cable

Assembling of the connector

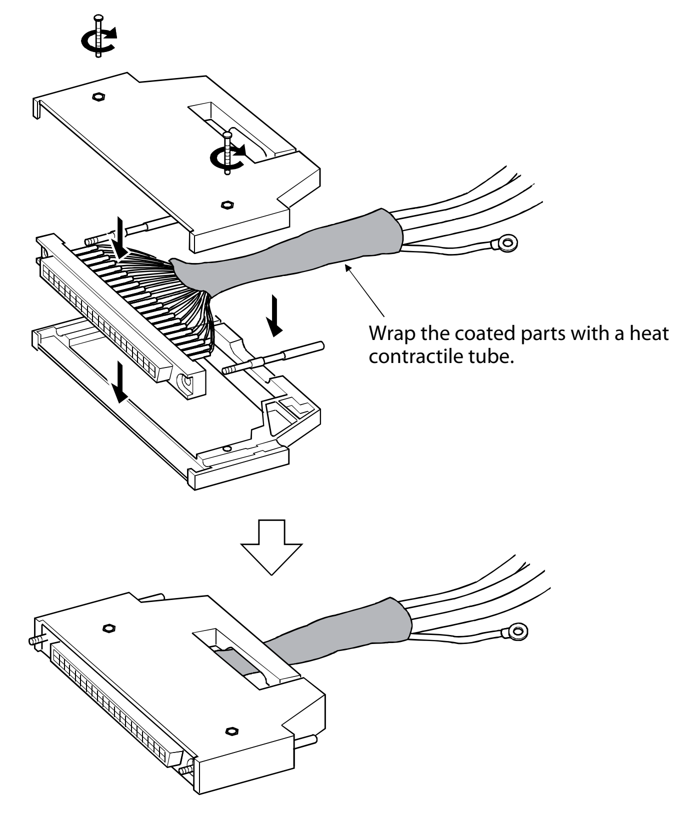


Fig. 4-5: Assembling of the connector (A6CON1)

- To make this product conform to the EMC and Low Voltage Directive, be sure to use a AD75CK type cable clamp (manufactured by Mitsubishi Electric) for grounding to the control box.

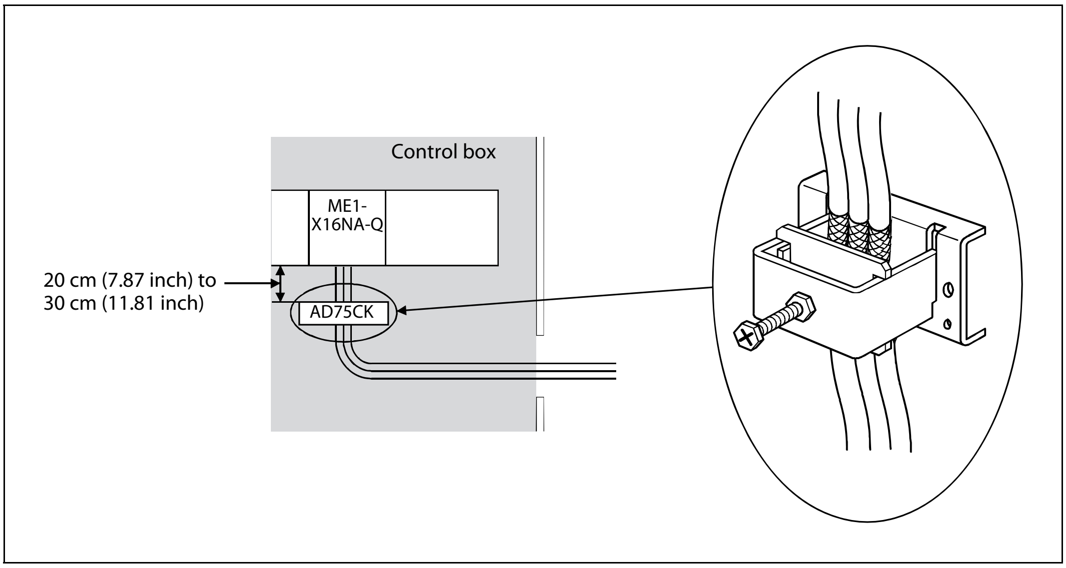


Fig. 4-6: *Grounding of a shielded cable using a AD75CK cable clamp*

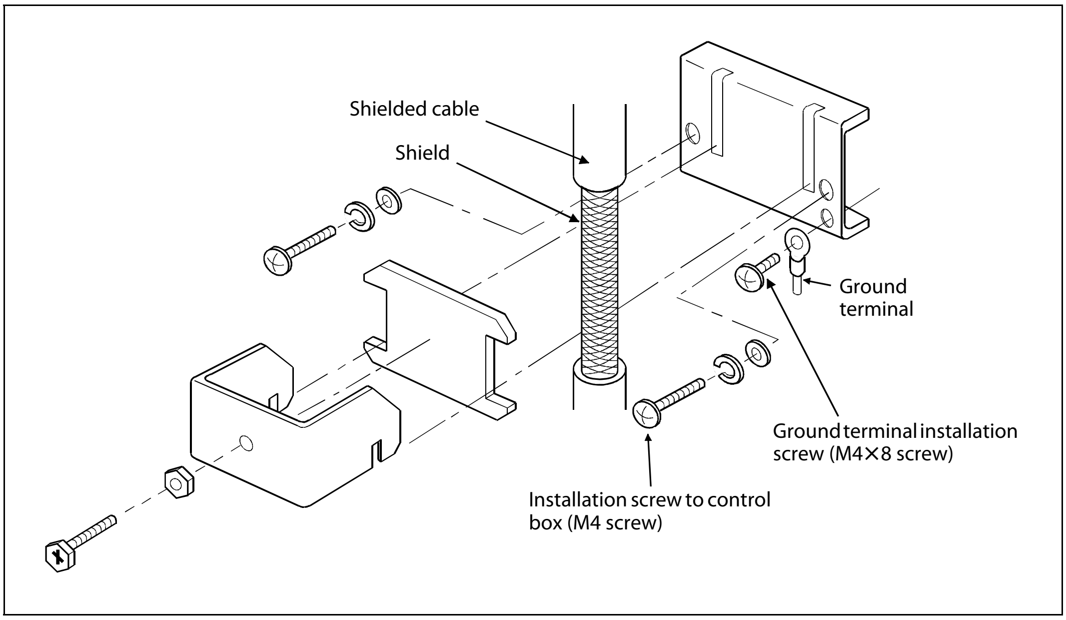


Fig. 4-7: *Mounting of a AD75CK cable clamp*

Using the AD75CK, you can tie four cables of about 7 mm outside diameter together for grounding.

- The influence of noise may be reduced by installing ferrite cores to the cable connected to the ME1X16NA-Q as a noise reduction technique.
- Even if compliance with the EMC directive is not required, the influence of external noise may be reduced by making the configuration compliant with the EMC directive.

4.4.2 External Wiring

Up to 16 NAMUR sensors can be connected to one ME1X16NA-Q. For connection, a 40-pin connector is used (refer to section 3.1.1).

Applicable cables

For best noise immunity, use shielded cable for the sensors. Ground the shield as described in the previous section 4.4.1.

External power supply

For operation of the ME1X16NA-Q, an external power supply of 24 V DC (+20%, -15%, which gives a voltage range of 20.4 to 28.8 V DC), is required.

Connect the external 24 V power to the pins 24V and 24G of the connector. One pole of the external power may be connected to earth.

Connection of the external wiring

WARNING:

- ***Leave the "vacant" pins unconnected.***
- ***Do not connect any voltage to a DI□ or VS□ pin.***

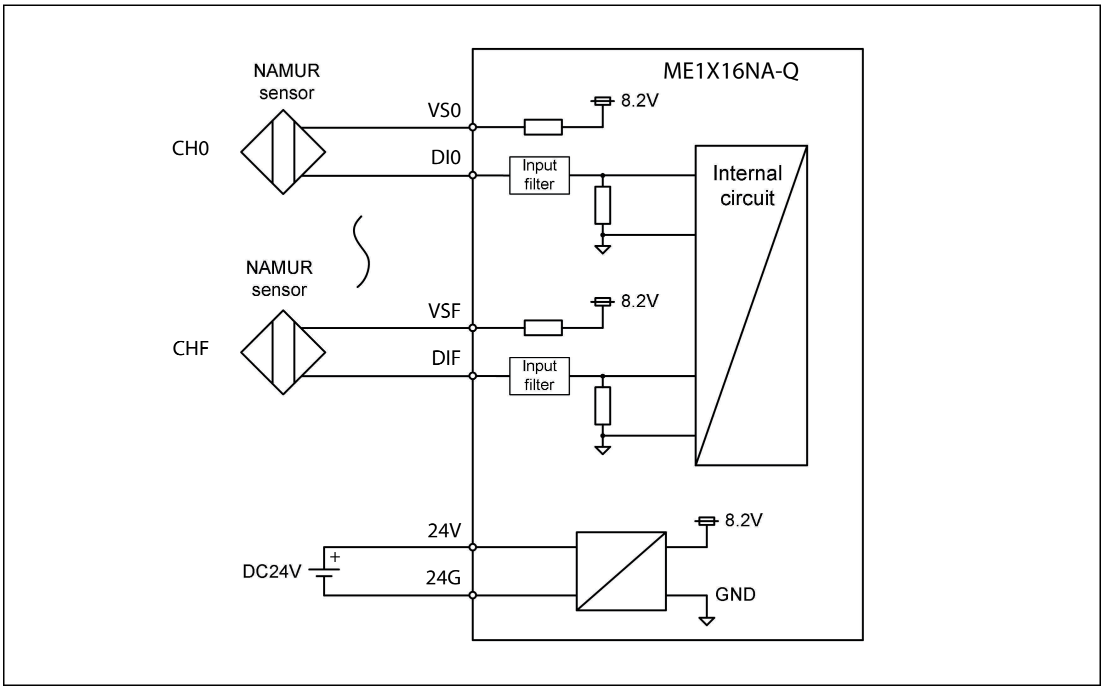


Fig. 4-8: *External wiring of the ME1X16NA-Q*

4.5 PLC Parameter Setting

In the PLC parameters the I/O assignment for the ME1X16NA-Q, the HOLD/CLEAR function and the fast conversion function are set.

4.5.1 I/O Assignment

Start GX Developer, GX IEC Developer or GX Works2 and open up the project with the ME1X16NA-Q. After the selection of ***Parameter*** in the Project Navigator Window, double click on ***PLC parameter***. The Q parameter setting window will appear. Click on the ***I/O assignment*** tab.

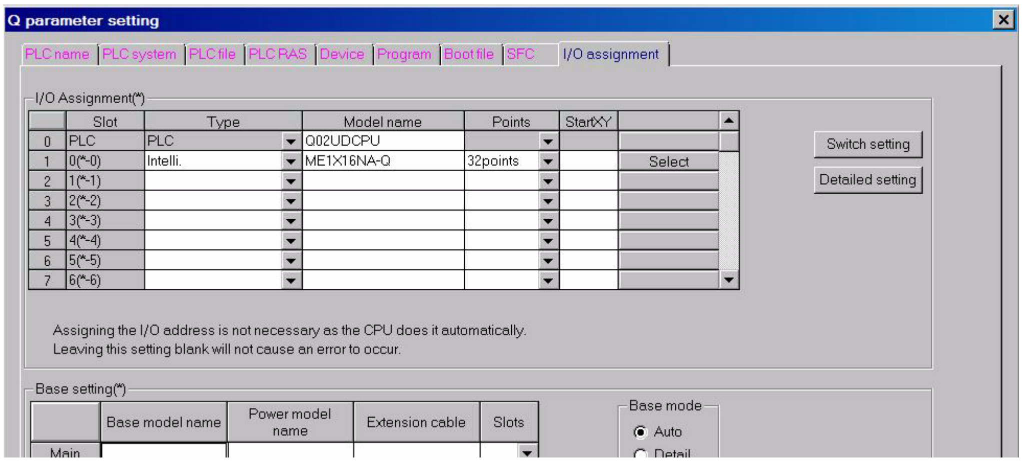


Fig. 4-9: *I/O assignment setting screen*

Set the following for the slot in which the ME1X16NA-Q is mounted:

Type: Select "Intelli."

Model name: ME1X16NA-Q (Entering of the module model name is optional. The entry is used for documentation only and has no effect on the function of the module.)

Points: Select 32 points.

StartXY: Start I/O number for the ME1X16NA-Q. (Assigning of the I/O address is not necessary as the address is automatically assigned by the PLC CPU.)

4.5.2 Intelligent Function Module Switch Settings

The HOLD/CLEAR setting and the Fast conversion mode for each input of the ME1X16NA-Q is selected by "switches" in the PLC parameters. There are no switches at the module itself.

HOLD/CLEAR function

When the internal communication is not stable or when there is no communication (e.g. the external 24 V are not present and the NAMUR circuit is not supplied), depending on the switch 3 settings the filtered input values in Un\G0 are reset to 0 (CLEAR) or latched (HOLD) until the communication is restored.

The wire break and short circuit flags in Un\G1 and Un\G2 are latched in any case until they are reset by error clear request using XnD/YnD and XnE/YnE signals.

Fast conversion mode

Since the NAMUR input circuit uses an analog low-pass filter with a time constant of 0.6 ms to improve signal quality, any change of the analog input value takes some time to load the filter capacitor. This leads to transient states when switching immediately from one state to another. For example, changing directly from wire break to short circuit will pass through 0-state and 1-state even though those states are not signalled by the sensor. To avoid this, all input values are delayed for 3 milliseconds to perform a consistency check.

This delay can be skipped by using fast conversion mode to reduce the time between an input signal change and the new module output by 3 ms, but in that case an output of the transient states described above may occur.

Switch 5 is used to enable or disable the fast conversion mode.

Setting the switches

The intelligent function module switches are set using 16 bit data (4 hexadecimal digits).

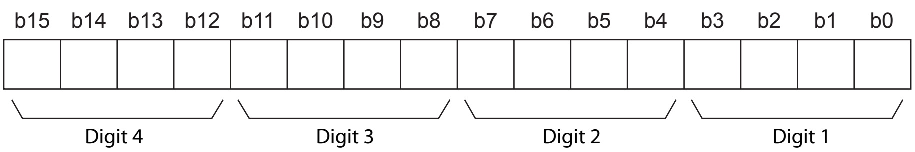


Fig. 4-10: *Bit assignment for one switch*

In the I/O assignment setting screen (section 4.5.1) click on ***Switch setting*** to display the screen shown below, then set the switches as required. The switches can easily be set if values are entered in hexadecimal. Change the entry format to hexadecimal and then enter the values.

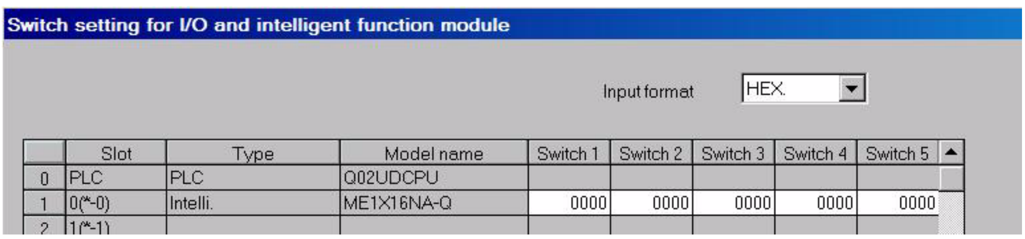


Fig. 4-11: *Switch setting for intelligent function module screen*

When the intelligent function module switches are not set, the default value for switches 1 to 5 is 0000H.

Switch	Setting item	
Switch 1	Reserved	Fixed to 0H
Switch 2	Reserved	Fixed to 0H
Switch 3	HOLD/CLEAR function setting (CH0 to CHF) b15 ~ b6 b5 b4 b3 b2 b1 b0 CHF ~ CH6 CH5 CH4 CH3 CH2 CH1 CH0	HOLD/CLEAR function setting for inputs CH0 to CHF 0: CLEAR 1: HOLD
Switch 4	Reserved	Fixed to 0H
Switch 5	Fast conversion mode (CH0 to CHF) b15 ~ b6 b5 b4 b3 b2 b1 b0 CHF ~ CH6 CH5 CH4 CH3 CH2 CH1 CH0	Fast conversion for inputs CH0 to CHF 0: Fast conversion mode for according NAMUR input disabled (default setting); additional output delay of 3 ms. 1: Fast conversion mode for according NAMUR input enabled; no additional output delay.

Tab. 4-2: *Switch settings for the ME1X16NA-Q*

- Setting example:

  The configuration shown below is used for the setting example.

Function		Input															
		CHF	CHE	CHD	CHC	CHB	CHA	CH9	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1	CH0
HOLD/CLEAR function setting	CLEAR (0)	●	●	●		●	●	●		●	●				●	●	●
	HOLD (1)				●				●			●	●	●			
Fast conversion mode	Disabled (0)					●	●	●		●	●	●	●	●	●		
	Enabled (1)	●	●	●	●				●							●	●

Tab. 4-3: *HOLD/CLEAR settings and Fast conversion mode for this example*

Setting value for switch 1:	0000H (fixed)
Setting value for switch 2:	0000H (fixed)
Setting value for switch 3 (HOLD/CLEAR):	0001 0001 0011 1000 = 1138H
Setting value for switch 4:	0000H (fixed)
Setting value for switch 5 (Fast conversion):	1111 0001 0000 0011 = F103H

5 Programming

This chapter describes the programming of the NAMUR input module ME1X16NA-Q.

NOTE When applying any of the program examples introduced in this chapter to the actual system, verify the applicability and confirm that no problems will occur in the system control.

5.1 Programming Procedure

Create a program that will execute the initial setting of the ME1X16NA-Q, the reading of input values and the error handling in the following procedure.

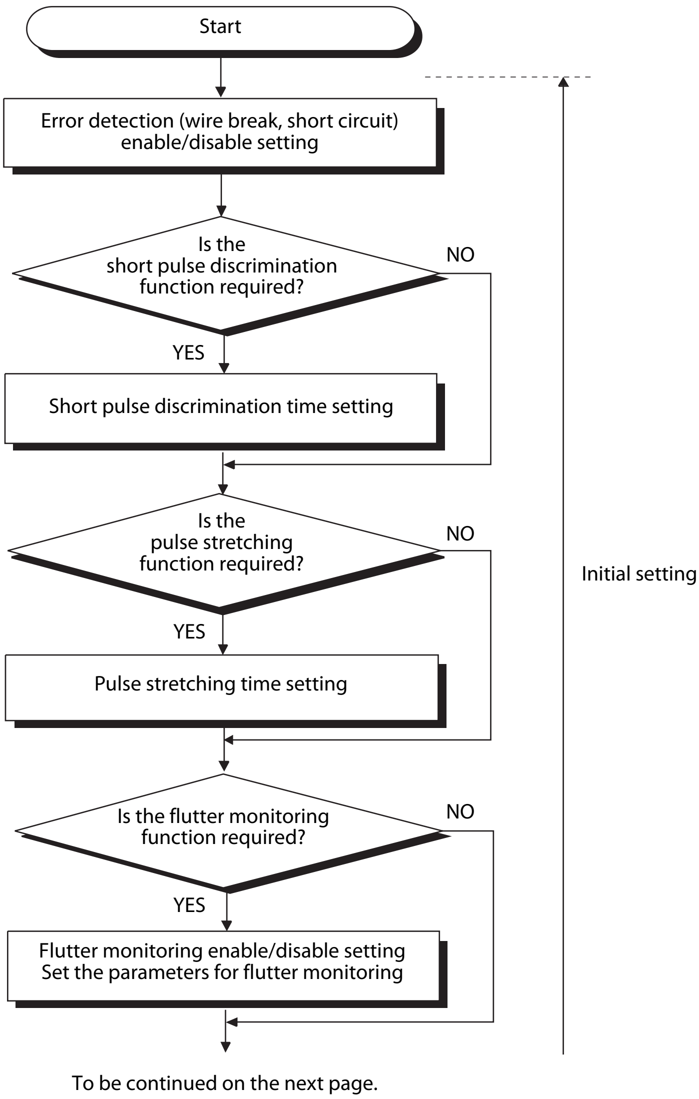


Fig. 5-1: *Programming procedure for the ME1X16NA-Q (1)*

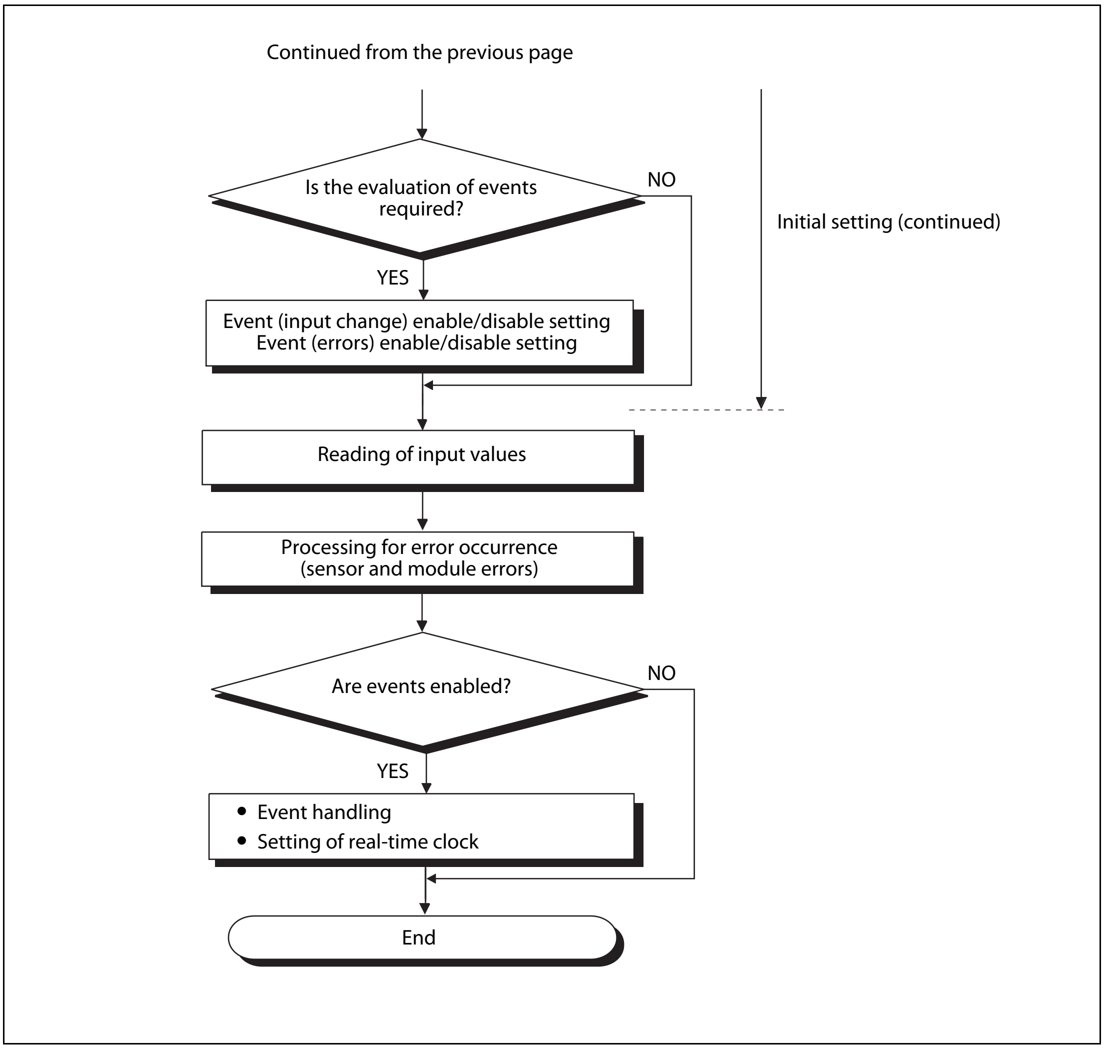


Fig. 5-2: *Programming procedure for the ME1X16NA-Q (2)*

5.2 Example 1: Reading of Input Values and Error Handling

This program example reads the input values from the ME1X16NA-Q and responds to sensor errors as well as module errors.

The following figure shows the system configuration used for this example. Eight NAMUR sensors are connected to a ME1X16NA-Q.

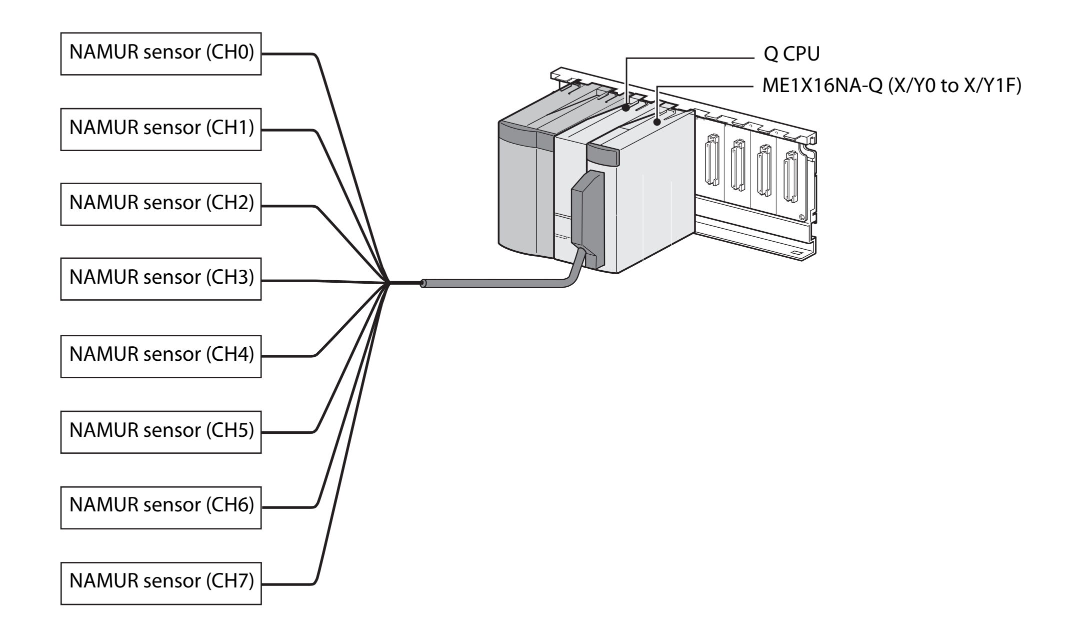


Fig. 5-3: *In this example eight NAMUR sensors are connected to the ME1X16NA-Q*

Input	HOLD/CLEAR function setting	Fast conversion mode
CH0 to CH7	CLEAR	Disabled
CH8 to CHF	—	—

Tab. 5-1: *Conditions for the intelligent function module switch setting*

Program conditions

- The input values from the NAMUR sensors are stored in the internal relays M100 to M115.
- Error detection is enabled for all connected sensors.

  In case of a wire break or short circuit processing for the error is performed.
- In case of a module error the error code is read and stored in the PLC CPU.

5.2.1 Before Creating a Program

Wiring of external devices

Mount the ME1X16NA-Q on the base unit and connect the external power supply and the NAMUR sensors. For details, refer to section 4.4.

Intelligent function module switch setting

Based on the setting conditions given on the previous page, perform the switch settings for the intelligent function module in the PLC parameters.

Since by default the HOLD/CLEAR setting is set to CLEAR and the fast conversion mode is disabled, no setting is necessary when a brand-new module is used. For a module used before in an other application, checking and setting of the switches is required.

Based on the setting conditions given previously, perform the intelligent function module switch settings.

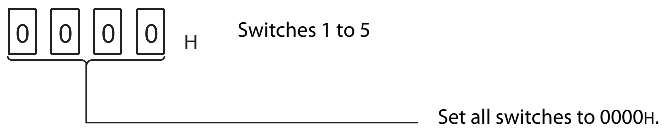


Fig. 5-4: *Setting of the switches 1 to 5 for this example*

On the **Parameter setting** screen of GX Developer, GX IEC Developer or GX Works2, select the ***I/O assignment*** tab, click ***Switch setting***, and make settings of the switches 1 to 5 as on the screen shown below (for details about the setting, refer to section 4.5.2).

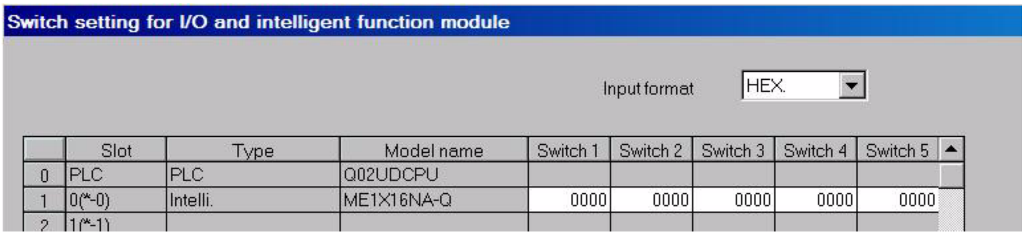


Fig. 5-5: *Switch setting for this example*

5.2.2 Program

For a full documentation of the instructions used with the examples please refer to the Programming Manual for the MELSEC System Q and the MELSEC-L series.

- Used Devices

Device		Function	Remark
Inputs	X0	Module ready	ME1X16NA-Q (X0 to X1F)
	X7	External 24 V ready	
	X9	Operating condition setting complete	
	XD	Wire break detection	
	XE	Short circuit detection	
	XF	Error flag	
Outputs	Y9	Operating condition setting request	ME1X16NA-Q (Y0 to Y1F)
	YD	Wire break detection clear request	
	YE	Short circuit detection clear request	
	YF	Error clear request	
Internal relays	M10	Wire break reset signal	—
	M11	Short circuit reset signal	—
	M12	Module error reset signal	—
	M100 to M115	Input value CH0 to CHF	Input values of all sensors are stored in M110 (CH0) to M115 (CHF).
	M120 to M135	Wire break NAMUR sensor CH0 to CHF	The wire break detection flags for all sensors are stored in M120 (CH0) to M135 (CHF).
	M140 to M155	Short circuit NAMUR sensor CH0 to CHF	The short circuit detection flags for all sensors are stored in M140 (CH0) to M155 (CHF).
Register	D100	Error code	Error code of the ME1X16NA-Q.

Tab. 5-2: *List of used devices*

- Initial settings

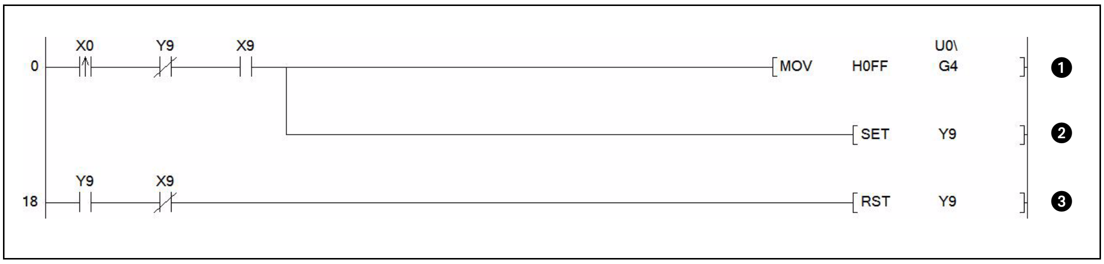


Fig. 5-6: *The initial settings are performed once when X0 (Module ready) turns on*

Number	Description
❶	Error (wire break and short circuit) detection enable/disable setting (CH0 to CH7: enable)
❷	The operation condition setting request (Y9) is turned ON.
❸	When the setting is completed, the operation condition setting request is turned OFF.

Tab. 5-3: *Description of the program for the initial settings*

● Reading of the input values, wire break detection flags and short circuit detection flags

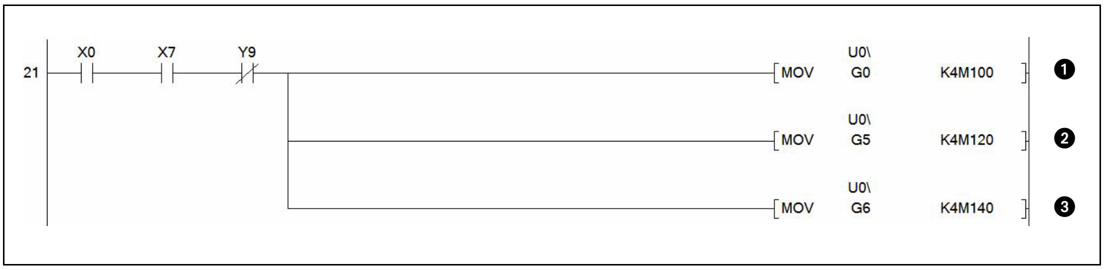


Fig. 5-7: *The input values are copied into internal relays*

Number	Description
❶	The input values are moved to the internal relays M100 to M115 for further processing in the program.
❷	The wire breaks flags are moved to the internal relays M120 to M135.
❸	The short circuit flags are moved to the internal relays M140 to M155.

Tab. 5-4: *Description of the program shown on the previous page*

● Processing at wire break detection and wire break detection clear request

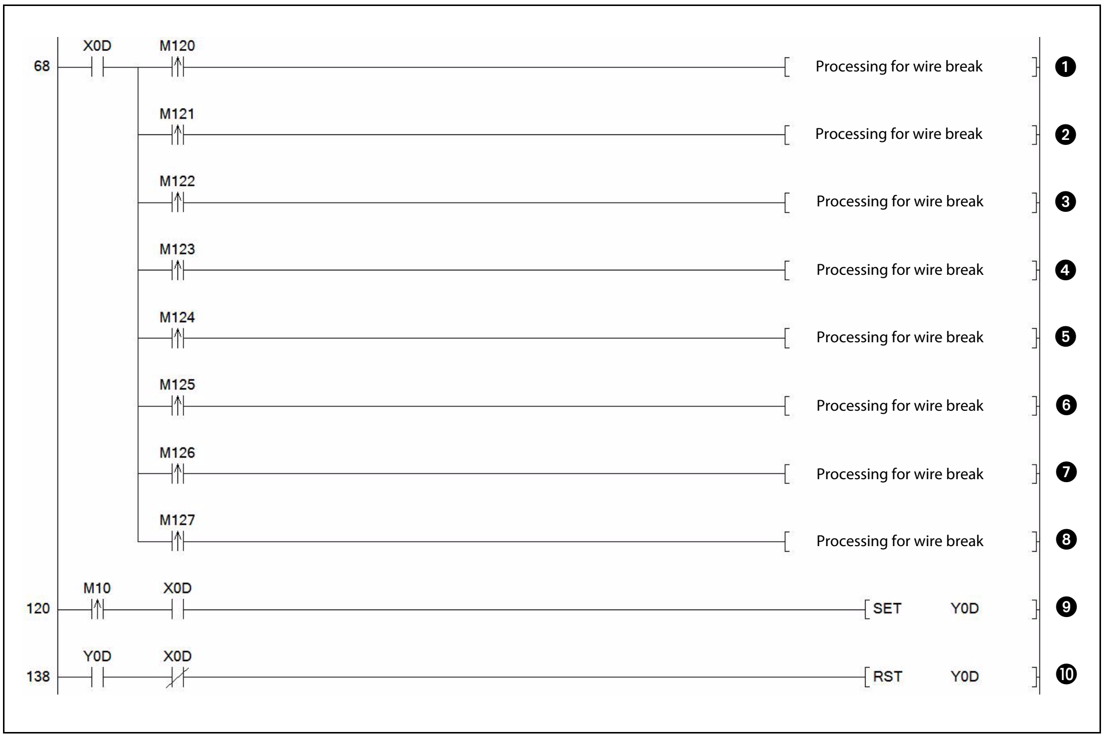


Fig. 5-8: *Program part for wire break processing*

Number	Description	
❶	When the module detects a wire break on at least one input, XD is switched ON. In case of a wire break, separate processing is performed for each input (e.g. issue of an alarm message, locking of the input in the program because the input value is set to "0" in this case, etc.).	Processing for input CH0
❷		Processing for input CH1
❸		Processing for input CH2
❹		Processing for input CH3
❺		Processing for input CH4
❻		Processing for input CH5
❼		Processing for input CH6
❽		Processing for input CH7

Tab. 5-5: *Description of the program shown above*

Number	Description
❾	When M10 (Wire break reset signal) is set while the wire break detection signal is ON, the wire break detection clear request (YD) is turned ON.
❿	When there is no wire break indicated, the wire break detection clear request (YD) is turned OFF.

Tab. 5-5: *Description of the program shown above*

● Processing at short circuit detection and short circuit detection clear request

Fig. 5-9: *Program part for short circuit processing*

<table>
<tr><th>Number</th><th colspan="2">Description</th></tr>
<tr><td>❶</td><td rowspan="8">When the module detects a short circuit on at least one input, XE is switched ON.
In case of a short circuit, separate processing is performed for each input (e.g. issue of an alarm message, locking of the input in the program because the input value is set to "0" in this case, etc.).</td><td>Processing for input CH0</td></tr>
<tr><td>❷</td><td>Processing for input CH1</td></tr>
<tr><td>❸</td><td>Processing for input CH2</td></tr>
<tr><td>❹</td><td>Processing for input CH3</td></tr>
<tr><td>❺</td><td>Processing for input CH4</td></tr>
<tr><td>❻</td><td>Processing for input CH5</td></tr>
<tr><td>❼</td><td>Processing for input CH6</td></tr>
<tr><td>❽</td><td>Processing for input CH7</td></tr>
<tr><td>❾</td><td colspan="2">When M11 (Short circuit reset signal) is set while the short circuit detection signal is ON, the short circuit detection clear request (YE) is turned ON.</td></tr>
<tr><td>❿</td><td colspan="2">When there is no short circuit indicated, the short circuit detection clear request (YE) is turned OFF.</td></tr>
</table>

Tab. 5-6: *Description of the program shown above*

- Module error detection

Fig. 5-10: *Module error detection and handling*

Number	Description
❶	In case of an error the error code is stored in D100.
❷	When an error has been detected and the reset signal (M12) is set to "1", the error clear request (YF) is set.
❸	When there is no error indicated, the error clear request (YF) is turned OFF.

Tab. 5-7: *Description of the program shown above*

5.3 Example 2: Signal Conditioning

In addition to the program shown in the previous section, in this program example some of the input signals are conditioned (elimination of short pulses, pulse stretching) and for one input the flutter monitoring function is used.

System configuration

In this example eight sensors are connected to a ME1X16NA-Q. The same system configuration as for example 1 is used (refer to section 5.2).

Program conditions

- The input values from the NAMUR sensors are stored in the internal relays M100 to M115.
- Error detection is enabled for all connected sensors.

  In case of a wire break or short circuit processing for the error is performed.
- In case of a module error the error code is read and stored in the PLC CPU.
- Short pulses on the inputs CH0 and CH2 are eliminated.
  - The minimum allowed pulse length for CH0 is 1.4 seconds.
  - The minimum allowed pulse length for CH2 is 0.8 seconds.
- Pulses on the input CH5 are extended to a minimum length of 1.5 seconds.
- For input CH6 the flutter monitoring function is activated. Eight or more signal changes in 2 seconds are recognized as flutter.

5.3.1 Before Creating a Program

Before creating the program, perform the steps described in section 5.3.1.

5.3.2 Program

For a full documentation of all instructions used with the examples please refer to the Programming Manual for the MELSEC System Q and the MELSEC-L series.

- Used Devices

Device		Function	Remark
Inputs	X0	Module ready	ME1X16NA-Q (X0 to X1F)
	X1	Flutter warning	
	X7	External 24 V ready	
	X9	Operating condition setting complete	
	XD	Wire break detection	
	XE	Short circuit detection	
	XF	Error flag	
Outputs	Y1	Flutter warning clear request	ME1X16NA-Q (Y0 to Y1F)
	Y9	Operating condition setting request	
	YD	Wire break detection clear request	
	YE	Short circuit detection clear request	
	YF	Error clear request	
Internal relays	M10	Wire break reset signal	—
	M11	Short circuit reset signal	—
	M12	Module error reset signal	—
	M13	Flutter warning reset signal	—
	M100 to M115	Input value CH0 to CHF	Input values of all sensors are stored in M110 (CH0) to M115 (CHF).
	M120 to M135	Wire break NAMUR sensor CH0 to CHF	The wire break detection flags for all sensors are stored in M120 (CH0) to M135 (CHF).
	M140 to M155	Short circuit NAMUR sensor CH0 to CHF	The short circuit detection flags for all sensors are stored in M140 (CH0) to M155 (CHF).
Register	D100	Error code	Error code of the ME1X16NA-Q.

Tab. 5-8: *List of used devices*

- Initial settings

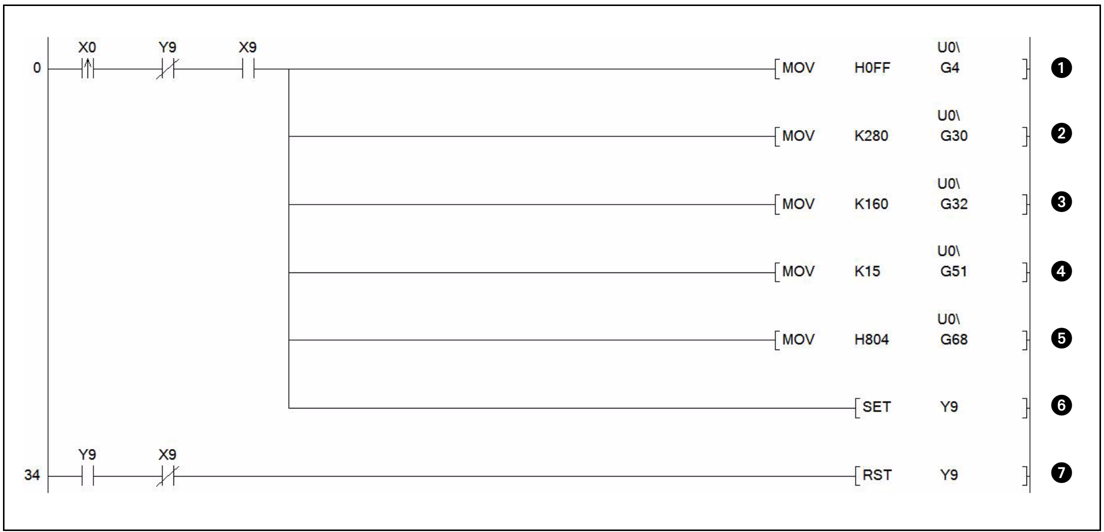


Fig. 5-11: *The initial settings are performed once when X0 (Module ready) turns on*

Number	Description	
❶	Error (wire break and short circuit) detection enable/disable setting (CH0 to CH7: enable)	
❷	Short pulse discrimination time setting	Input CH0: 1.4 s = 1400 ms = 280 × 5 ms → The value 280 is stored in Un\G30.
❸		Input CH2: 0.8 s = 800 ms = 160 × 5 ms → The value 160 is stored in Un\G32.
❹	Pulse stretching time setting for input CH5: 1.5 s = 1500 ms = 15 × 100 ms → The value 15 is stored in Un\G51.	
❺	Setting of flutter monitoring parameters for input CH6 (n = 8, t = 2 s = 4 × 500 ms → The value 0804H is stored in Un\G68.)	
❻	The operation condition setting request (Y9) is turned ON.	
❼	When the setting is completed, the operation condition setting request is turned OFF.	

Tab. 5-9: *Description of the program for the initial settings*

- Reading of input values, wire break detection flags, short circuit detection flags and error processing

  The processing is the same as performed for example 1. (Please refer to section 5.2.2.)

- Flutter monitoring

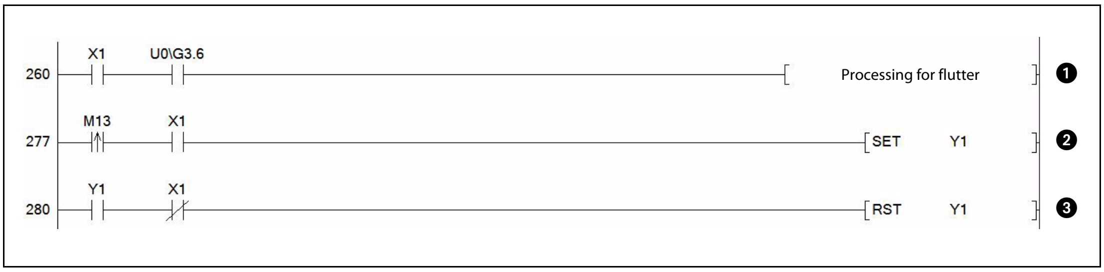


Fig. 5-12: *Flutter detection and handling*

Number	Description
❶	When flutter is detected for input CH6, bit 6 is set in Un\G3.
❷	M13 is used to switch the flutter warning clear request (Y1) ON.
❸	When there is no more flutter warning, the flutter warning clear request (Y1) is turned OFF.

Tab. 5-10: *Description of the program shown above*

6 Troubleshooting

The following section explains the types of errors that may occur when the NAMUR input module ME1X16NA-Q is used, and how to troubleshoot such errors.

6.1 Error Code List

If an error occurs in the ME1X16NA-Q while writing to or reading data from the programmable controller CPU, an error code is written to buffer memory address 90 (Un\G90).

Error code (decimal)	Error description	Corrective action
30 to 45	The setting for the short pulse discrimination time for an input is outside the range of 0 to 400.	The error code shows the buffer memory address containing the incorrect value (30 = Un\G30 for input CH0 to 45 = Un\G45 for input CHF). Set a value within 0 to 400.
46 to 61	The setting for the pulse stretching time for an input is outside the range of 0 to 20.	The error code shows the buffer memory address containing the incorrect value (46 = Un\G46 for input CH0 to 61 = Un\G61 for input CHF). Set a value within 0 to 20.
62 to 77	At least one of the flutter monitoring parameters is out of range.	The error code shows the buffer memory address containing the incorrect value (62 = Un\G62 for input CH0 to 77 = Un\G77 for input CHF). Set the flutter monitoring parameters to within its valid ranges: ● Flutter monitoring window: 0 to 120 ● Maximum no. of allowed signal changes: 2 to 31
80 to 87	While updating the real-time clock (Yn2), the real-time clock setting value (Un\G80 to Un\G87) is out of range.	Make sure the clock data is written in the correct format into Un\G80 to Un\G87 before switching the signal Yn2 ON.
100	External 24 V not connected or hardware error of the NAMUR input circuit.	Connect the external 24 V or turn the 24 V OFF and ON again. If the error occurs again, the module may be malfunctioning. Please consult your local Mitsubishi representative, explaining the detailed description of the problem.
111	Hardware error of the module.	Turn the power OFF and ON again. If the error occurs again, the module may be malfunctioning. Please consult your local Mitsubishi representative, explaining the detailed description of the problem.

Tab. 6-1: *Error code list*

NOTE When two or more errors have occurred, the latest error found by the ME1X16NA-Q is stored.

6.2 Troubleshooting by Symptom

6.2.1 When the LEDs of the ME1X16NA-Q are not turned ON

Check item	Corrective action
Is the power being supplied to the PLC?	Confirm that the supply voltage for the power supply module is within the rated range.
Is the capacity of the power supply module adequate?	Calculate the current consumption of the CPU module, I/O modules and intelligent function modules mounted on the base unit to see if the power supply capacity is adequate.
Has a watchdog timer error occurred?	Reset the programmable controller CPU and verify that it is lit. If the RUN LED does not light even after doing this, the module may be malfunctioning. Please consult your local Mitsubishi representative, explaining the detailed description of the problem.
Is the ME1X16NA-Q correctly mounted on the base unit?	Check the mounting condition of the module.
Has an error occurred in the ME1X16NA-Q?	• Check that the input signal Xn0 (Module ready) is ON (refer to section 3.4.2). • Check whether the input signal XnF (Error) is ON (refer to section 3.4.2). • Check the buffer memory address 90 (Un\G90) for an error code and take corrective action as described in section 6.1.
Is 24 V DC external supply power being supplied to the ME1X16NA-Q?	• Check that the external supply power terminals (terminals No. A1 and B1) are supplied with a 24 V DC voltage. • Check that the input signal Xn7 (External 24V ready) is ON. • Check the buffer memory address 90 (Un\G90) for an error code and take corrective action as described in section 6.1.
Is the NAMUR sensor correctly connected to the ME1X16NA-Q?	Check the connection status of the sensor (section 4.4).
Is the connected NAMUR sensor working correctly?	Check the device connected to the input.
Is there any fault with the signal lines such as disconnection or wire break?	Check for faulty condition of the signal lines by a visual check and a continuity check.

Tab. 6-2: *When the LEDs are not turned ON*

6.2.2 When the Input Values cannot be read

Check item	Corrective action
Is an error being generated?	Check the buffer memory address 90 (Un\G90) for an error code and take corrective action as described in section 6.1.
Are the input values being written to the buffer memory?	• Verify the contents of the buffer memory address Un\G0 in the monitor of GX (IEC) Developer or GX Works2. • Check the sensor connected to the input.
Are the input values moved from the buffer memory of the ME1X16NA-Q to the PLC CPU correctly?	• Check the sequence program. Make sure that the input values are taken out of the correct buffer memory address (Un\G0). • Check that data is not moved from different sources into the same storage destination in the PLC CPU.

Tab. 6-3: *When the input values cannot be read*

6.2.3 When Wire Breaks and Short Circuits are not detected

Check item	Corrective action
Is the detection of wire breaks and short circuits enabled in the buffer memory address Un\G4?	Enable the detection of wire breaks and short circuits for the respective input in Un\G4.
Has the operating condition setting request (Yn9) been executed?	After a change in the buffer memory address Un\G4 the operating condition setting request (Yn9) must be switched ON to make the setting valid. Review the initial setting in the sequence program.

Tab. 6-4: *When wire breaks and short circuits are not detected*

6.2.4 When there is always a Wire Break detected (XnD is ON)

Check item	Corrective action
Is the detection of wire break and short circuit enabled for an unused input?	Disable the detection of wire breaks and short circuits for unused inputs in Un\G4 (refer to section 3.5.6).

Tab. 6-5: *When a wire break for an unused input is detected*

6.2.5 When Flutter is not detected

Check item	Corrective action
Is the flutter monitoring enabled for the input?	The flutter monitoring parameters are set in the buffer memory addresses Un\G62 to Un\G77 (section 3.5.14). • When the window time is set to 0, the flutter monitoring function is disabled for the respective input. • When a value outside the allowed range is entered for the parameters, an error is detected and an error code is stored in the buffer memory address 90 (Un\G90). Review the settings of the parameters.
Are the flutter monitoring parameters set correctly?	
Has the operating condition setting request (Yn9) been executed?	After changing the flutter monitoring parameters in one of the buffer memory addresses Un\G62 to Un\G77, the operating condition setting request (Yn9) must be switched ON to make the settings valid. Review the sequence program.

Tab. 6-6: *When flutter is not detected*

6.2.6 When Events are not recorded

Check item	Corrective action
Is the specific event enabled?	Enable the event for the respective input in one of the following buffer memory addresses: – Un\G8 (positive edge of input) (section 3.5.9) – Un\G9 (negative edge pf input) (section 3.5.9) – Un\G10 (wire break, short circuit, flutter) (section 3.5.10)
Has the operating condition setting request (Yn9) been executed?	After changing the event buffer enable settings in one of the buffer memory addresses Un\G8 to Un\G10, the operating condition setting request (Yn9) must be switched ON to make the settings valid. Review the sequence program.
Is the event buffer full?	Check the status of the signal Xn5 (event buffer full). If this signal is ON, use the Yn4/Xn4 handshake to read out the events (refer to section 3.3.4). Or use the signal Yn5 to clear the event buffer.

Tab. 6-7: *When events are not detected*

6.2.7 When the Short Pulse Discrimination Function is not working

Check item	Corrective action
Is the short pulse discrimination time set correctly?	The short pulse discrimination time is set in the buffer memory addresses Un\G30 to Un\G45 (refer to section 3.5.12). • When the time is set to 0, the short pulse discrimination is disabled for the respective input. • When a value outside the allowed range is entered for the time, an error is detected and an error code is stored in the buffer memory address 90 (Un\G90). Check the buffer memory address Un\G90 for an error code and take corrective action as described in section 6.1. Review the setting of the parameters.
Has the operating condition setting request (Yn9) been executed?	After changing the short pulse discrimination time in one of the buffer memory addresses Un\G30 to Un\G45, the operating condition setting request (Yn9) must be switched ON to make the settings valid. Review the sequence program.

Tab. 6-8: *When short pulses are not eliminated*

6.2.8 When the Pulse Stretching Function is not working

Check item	Corrective action
Is the pulse stretching time set correctly?	The pulse stretching time is set in the buffer memory addresses Un\G46 to Un\G61 (refer to section 3.5.13). • When the time is set to 0, the pulse stretching is disabled for the respective input. • When a value outside the allowed range is entered for the time, an error is detected and an error code is stored in the buffer memory address 90 (Un\G90). Check the buffer memory address Un\G90 for an error code and take corrective action as described in section 6.1. Review the setting of the parameters.
Has the operating condition setting request (Yn9) been executed?	After changing the short pulse discrimination time in one of the buffer memory addresses Un\G46 to Un\G61, the operating condition setting request (Yn9) must be switched ON to make the settings valid. Review the sequence program.

Tab. 6-9: *When pulse stretching is not working*

6.3 Checking the Module Status

When the analog output module detail information is selected in GX Developer, GX IEC Developer or GX Works2 system monitor, an error code and the status of the intelligent function module switch setting can be checked.

- Operating GX Developer

  In the **Diagnostics** menu select **System monitor**.

- Operating GX IEC Developer

  In the **Debug** menu select **System monitor**.

- Operating GX Works2

  In the **Diagnostics** menu select **System Monitor**.

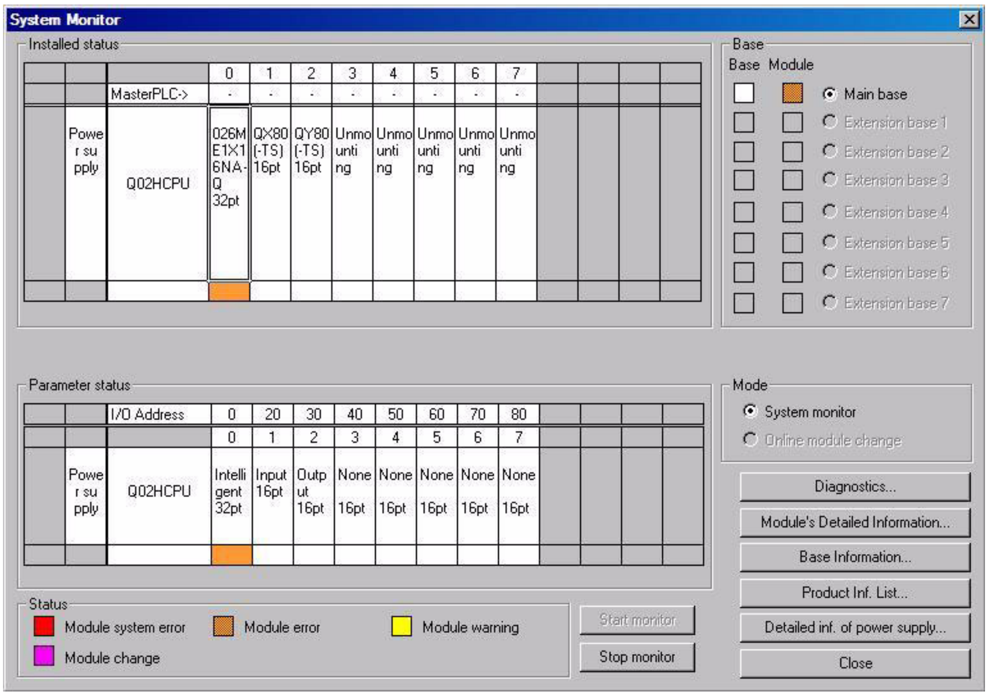


Fig. 6-1: *The System Monitor displays comprehensive information of the connected PLC*

For further information about a module, click on the module and then click ***Module Detailed Information.***

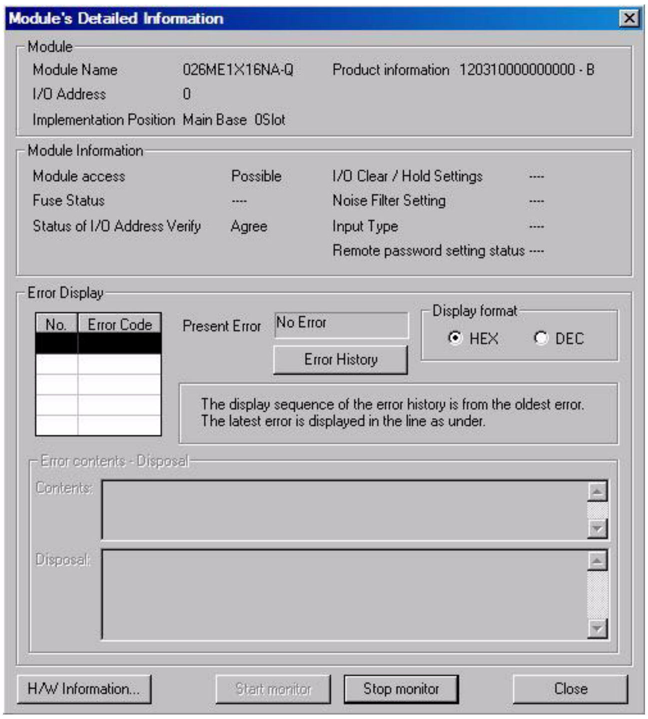


Fig. 6-2: *Detailed information on the selected module allow an easy and quick troubleshooting*

Contents of Module's Detailed Information

- Module
  - Module Name: Shows the designation of the module, e.g. ME1X16NA-Q
  - I/O Address: Head address of the module
  - Implementation Position: Shows whether the module is mounted to the main base or to an extension base and the position of the module.
  - Product information: Serial No. of the module. The letter shows the function version.
- Module Information
  - Module access: Shows whether the module is ready or not.
  - Fuse status: Not relevant for the ME1X16NA-Q.
  - Status of I/O Address Verify: Indicates whether the parameter set module and the installed module are identical.
  - I/O Clear / Hold Settings, Noise Filter Setting, etc.: Not relevant for the ME1X16NA-Q.
- Error Display
  - Checking the error code
    The error code stored in buffer memory address 90 (Un\G90) of the ME1X16NA-Q is displayed in the **Present Error** field.

    When the ***Error History*** button is pressed, the contents displayed in the **Present Error** field is displayed in the No. 1 field.

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