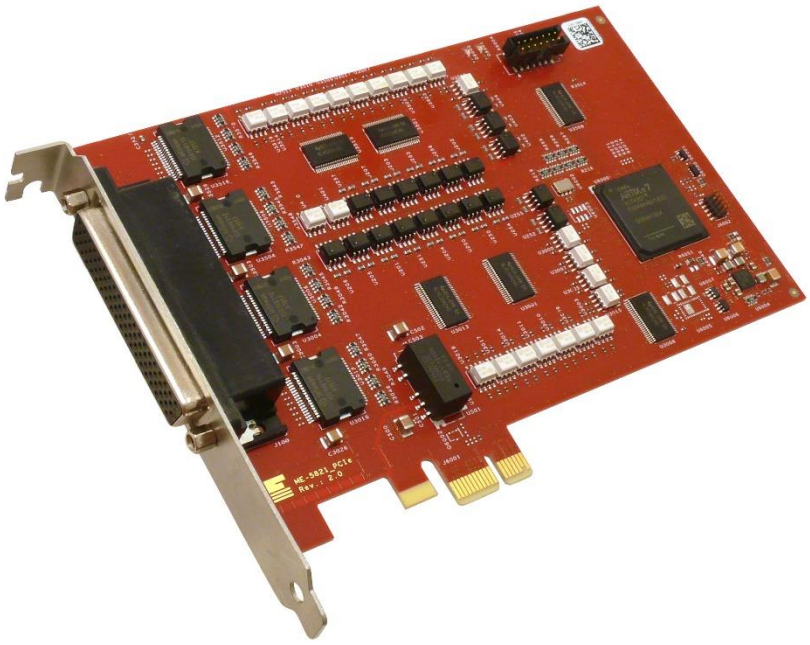
MEILHAUS ELECTRONIC

Meilhaus Electronic Manual

ME-582x Series



Opto-Isolated Digital-I/O Board

with Bit-Pattern Detection, 3 x 16-bit Counters (8254 compatible)
(alternatively: Frequency Measurement and Pulse Generator)

Imprint

Manual ME-582x Series

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1 Introduction

Valued customer,

Thank you for purchasing this device from Meilhaus Electronic. You have chosen an innovative high-technology product that left our premises in a fully functional and new condition.

Please take the time to carefully examine the contents of the package for any loss or damage that may have occurred during shipping. If there are any items missing or if an item is damaged, please contact us immediately.

Before installing the board in your computer, we recommend you read this manual carefully, especially the chapter describing board installation.

1.1 Important Notes

1.1.1 Use in Accordance with the Requirements

The PC boards of the ME-series are designed for acquisition and output of digital signals using a PC. Depending on type, install the models of the ME-series into:

a free PCI-Express slot (PCIe versions) or

a free PXI-Express slot (3 HE PXI express versions)

For information on how to install a plug-in board, read the manual of your PC.

Please note the instructions and specifications as presented in this manual (Appendix, from page 29 on):

- Please ensure sufficient heat dissipation for the board within the PC housing.
- The opto-isolated inputs and outputs achieve an electrical isolation of the application relative to PC ground.
- Note that the computer must be powered up, prior connecting signals by the external wiring of the board.
- As a basic principle, all connections to the board should only be made or removed in a powered-down state of all components.
- Ensure that no static discharge occurs while handling the board or while connecting/disconnecting the external cable.
- Ensure that the connection cable is properly connected. It must be seated firmly on the D-Sub connector and must be tightened with both

screws, otherwise proper operation of the board cannot be guaranteed!

1.1.2 Improper Application

PC plug-in boards for the PCI-Express- or PXI-Express-bus may not be taken into operation outside of the PC. Never connect the devices with voltage-carrying parts, especially not with mains voltage.

Make sure that no contact with voltage-carrying parts can happen by the external wiring of the device. As a basic principle, all connections should only be made or removed in a powered-down state.

1.1.3 Unforeseeable Misapplications

The device is not suitable to be used as a children's toy, in the household or under unfavourable environmental conditions (e.g. in the open). Appropriate precautions to avoid any unforeseeable misapplication must be taken by the user.

1.2 Package Contents

We take great care to ensure your delivery is complete. Nonetheless, please check the list enclosed to verify the contents of your delivery. You should find included:

- Opto-isolated digital-I/O boards for the PCI-Express- or PXI-Express-bus of type ME-5820 or ME-5821
- Manual in PDF format on DVD (optionally available in printed form).
- Driver software on DVD.
- 78-pin D-sub mating connector.

1.3 Features

The ME-5820 series PC boards are opto-isolated digital-I/O boards with bit-pattern detection and counters for PCI-Express- and PXI-Express-systems. In this user manual "ME-582x" is used for all versions of the cards, whereas "ME-5820" or "ME-5821" is used to describe special features of these versions.

If required, certain subdevices can alternatively be configured for frequency measurement or for pulse generation (see chapter 4 from page 20).

Model overview:

Model	Opto-Dio	Opto-FIO*	Counter
ME-5820	1 x 16 bit DI 1 x 16 bit DO	4 FI channels 4 FO channels	3 x 16 bit
ME-5821	2 x 16 bit DI 2 x 16 bit DO	4 + 4 FI channels 4 + 4 FO channels	3 x 16 bit

Table 1: Model overview ME-5820 series

Alternative configuration can be selected with ME-iDC.

- **Opto-isolated digital-inputs**: The ME-5820 has 16 opto-isolated inputs, ME-5821 has 32 opto-isolated inputs. The inputs run with a voltage high level of 5…60 V (specifications see page 29).
- **Opto-isolated digital outputs**: ME-5820 has 16 opto-isolated outputs, ME-5821 has 32 opto-isolated outputs. The source-driver can drive up to 370 mA per pin (all 16 outputs active). The detailed specifications of the sink and/or source drivers can be found on page 29. The source drivers are short-circuit-proof and are equipped with a current limiting per channel. If required, the output driver can send an interrupt on overload to the PC.
  A suitable external source is required to supply the output drivers.
- **Frequency measurement:** With the concept of “configurable subdevices” the subdevice 0 and subdevice 5 (ME-5821 only) can also be used as a frequency counter. Four (8) independent channels are available to measure the frequency and duty cycle of periodic rectangular signals (max. 300 kHz)..
- **Pulse generator:** With the concept of “configurable subdevices” the subdevice 1 and subdevice 6 (ME-5821 only) can also be used as a rectangular signal generator. Four (8) independent channels are available to output a periodic rectangular signal up to 3 kHz with selectable duty cycle.
- **Sink/source selection:** You can switch the output ports over from sink to source drivers or high impedance by software for an optimal adaption in industrial applications. “High impedance” means that the voltage level at the output pin depends on your external application.
- **Bit-pattern detection:** If required, the bit-pattern at the digital input port can be monitored. Depending on the mode an interrupt can be generated, if the bit-pattern changes or is equal/not equal to a given bit-pattern.
- The isolation voltage between the opto-isolated inputs/outputs and PC-ground is 1 $kVAC_{RMS}$.
- The opto-isolated digital inputs of the ME-582x are equipped with an overvoltage protection diode that can discharge voltage pulses to ground for a short period of time.

Depending on your application you can select between these operating modes:

- **Single:** In this mode a single value can be read or written under software control (see chapter 4.1.1 on page 22).
- **Interrupt**: Used for interrupt processing in bit-pattern change and bit-pattern compare mode (see chapter 4.3 on page 26).

Custom specific firmware versions are available on request.

1.4 System Requirements

The ME-582x may be installed into any PC (Intel® Pentium® processor) with a free standard PCI-Express- or PXIExpress-slot. The board is supported by the Meilhaus Electronic Intelligent Driver System (ME-iDS).

1.5 Software Support

The ME-series is supported by the Meilhaus Electronic Intelligent Driver System (ME-iDS). The ME-iDS is a unique driver system covering different devices and operating systems. It supports Windows 7, 8.1, 10 and contains a universal function library (API) for all common programming languages.

A detailed description of the functions can be found in the ME-iDS manual on the CD/DVD enclosed.

Please also note the corresponding README-files.

2 Initial Operation

Please read your computer's instruction manual on how to install new hardware components **before installing the board**.

2.1 Software Installation

- Installation under Windows

The following basic procedure should be used:

If you have received the driver software as an archive file, please unpack the software **before installing the board**. First choose a directory on your computer (e.g. C:\Temp\Meilhaus\ME-iDS).

Use the Meilhaus Electronic Intelligent Driver System (ME-iDS) for programming your new data acquisition hardware. For installation and operation of the driver system, please follow the documentation in electronic form included with the software package.

2.2 Test Program

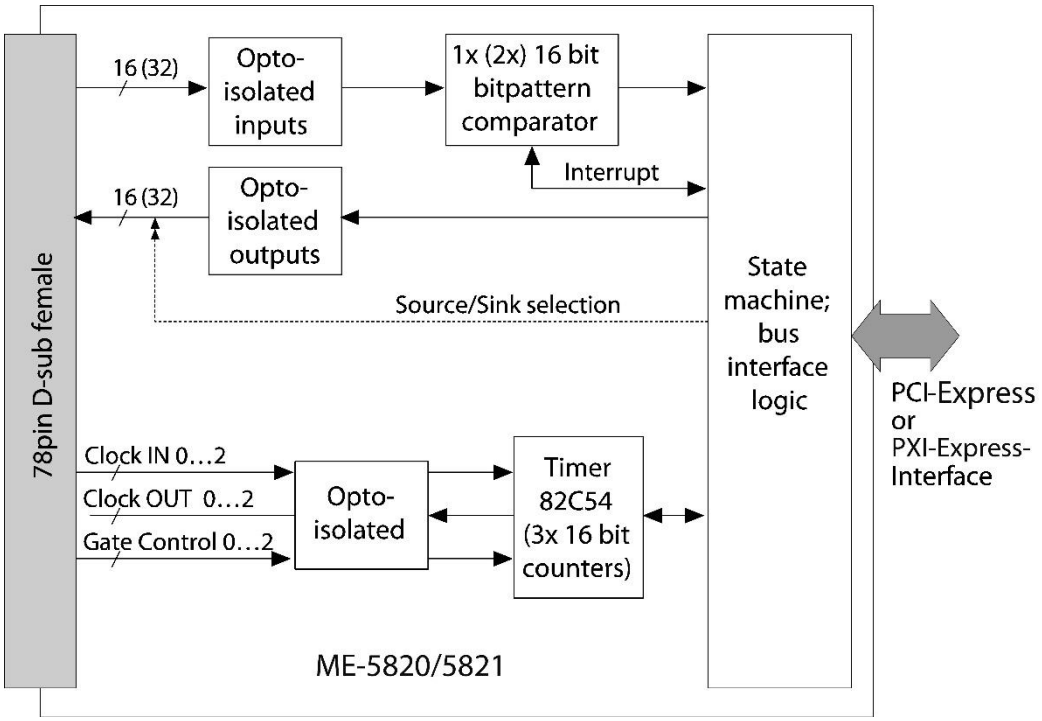
For simple testing of the board use the corresponding test program provided with the ME-iDS.

ME-PowerLab[3]. Run the program from the Windows Start menu. This will allow you to text all the important functions of the hardware.

- You will find simple test programs in the SDK of the ME-iDS, in the "Test Executables32" or "Test Executables64" subfolders.

3 Hardware

3.1 Block Picture

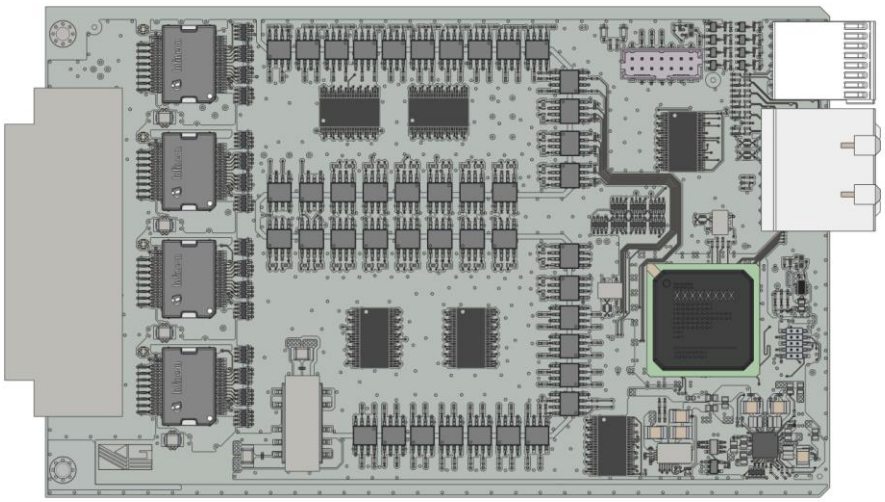


Picture 1: Block picture of ME-5820/21

Pinout picture of the 78-pin D-sub female connector in the appendix (see “Pinout” page 36).

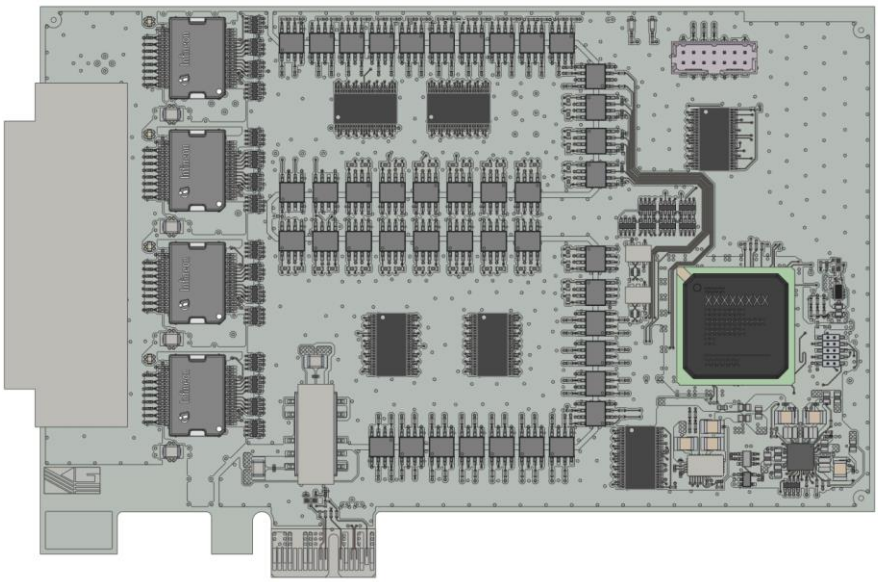
In the following chapters you will learn more about the external wiring of the functional sections. Chapter 4 from page 20 describes the operation modes and the programming.

3.2 ME-582x PXIe



Picture 2: ME-5821 PXIe

3.3 ME-582x PCIe



Picture 3: ME-5821 PCIe

3.4 Digital Input/Output

The ME-582x opto-isolated ports have been designed for applications in industrial control applications (typ. 24 V). An external power supply (pin: VCC_EXT) is required for the opto-isolated digital-I/O section. Depending on the application, the drivers of the output ports can be configured as sink or source or high impedance via software. The isolation voltage to PC-ground is 1000 VAC_{RMS}.

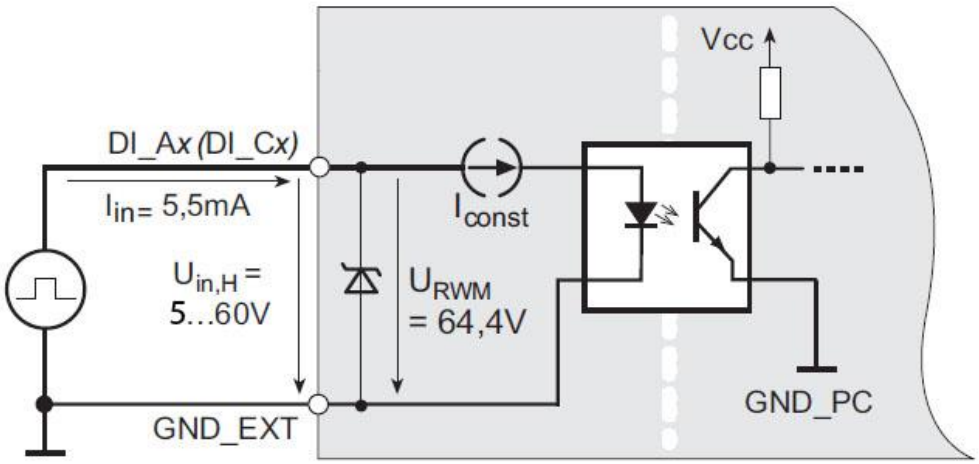
The ME-5820 has 16 opto-isolated inputs (port A) and 16 opto-isolated outputs (port B). The ME-5821 has 32 opto-isolated inputs (port A and port C) and 32 opto-isolated outputs (port B and port D). Due to the opto-isolation, the port direction is fixed.

The programming of the various operating modes is described in chapter 4.1 from page 22.

3.4.1 Opto-Isolated Inputs

The ME-5820 has 16 opto-isolated inputs (port A).ME-5821 has 32 opto-isolated inputs (port A and port C).

The inputs have been designed for an input high-level $U_{in,H}$ = 3…60 V. A reference to the ground of the external circuitry via GND_EXT (pins 9, 11, 59) has to be setup in any case. The input lines show logic “0” if not connected.



Picture 4: Inputs of the ME-5820

The opto-isolated digital-inputs of the ME-5820 series are protected from over-voltages with special Z-diodes, so called Transient Voltage Suppressor diodes (TVS diodes). These diodes can discharge short voltage pulses with U_{RWM} (Reverse Working Maximum) greater than 64.4 V to ground (max. 600 W pulse power at a pulse width of 1 ms).

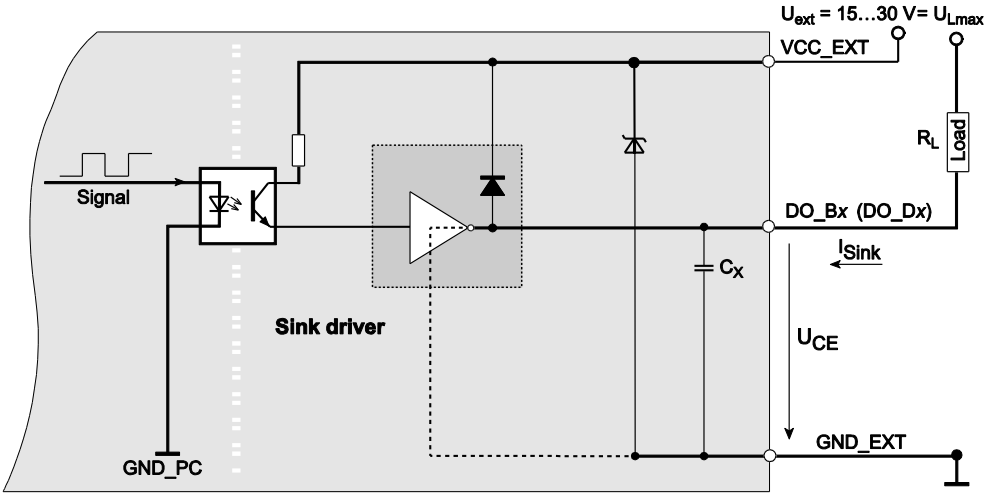
3.4.2 Opto-Isolated Outputs

The ME-5820 has 16 opto-isolated outputs (port B), ME-5821 has 32 opto-isolated outputs (port B and port D).

The ME-582x output ports are equipped with special driver chips that allow a selection of sink and source via software. Depending on the application, the user can switch between low-active outputs (sink driver = standard setting) and high-active outputs (source driver) via software. Moreover, the output ports can be set to high impedance. A reference to the ground of the external wiring via GND_EXT (pins 9, 11, 59) has to be setup in any case.

3.4.2.1 Sink Driver

Each output is equipped with two sink driver chips of type ULN2803, detailed specifications see page 29.

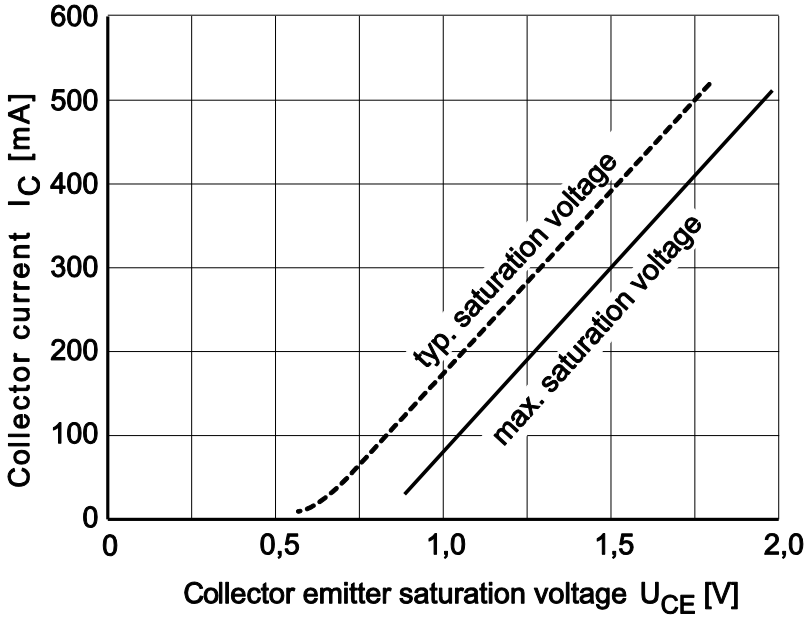


Picture 5: ME-5820/21 outputs with sink drivers

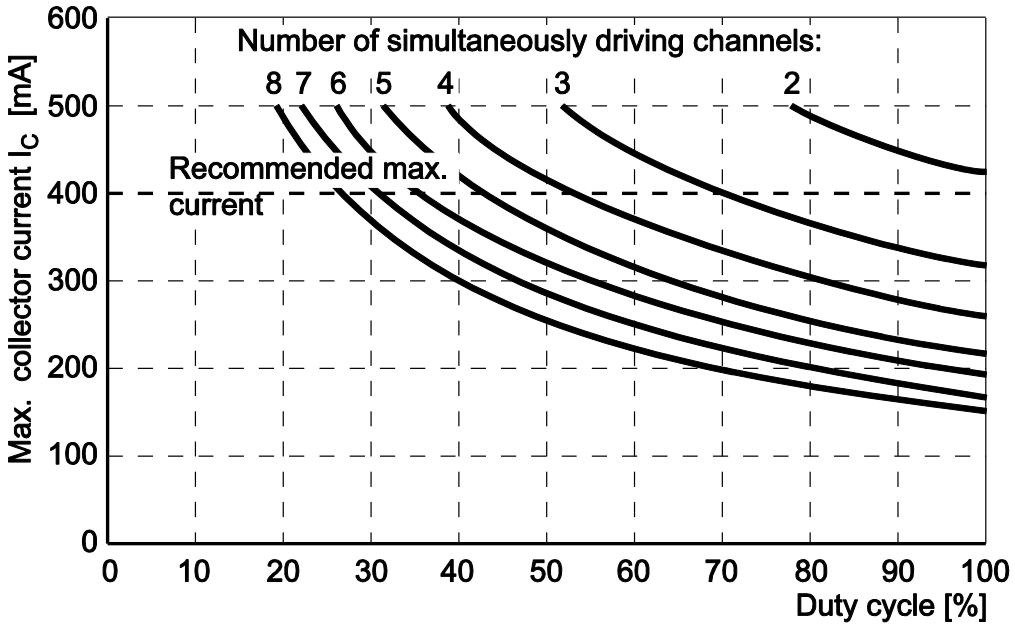
The maximum current per output ($I_C = I_{Sink}$) depends on the saturation voltage U_{CE} and is limited by the power loss of the sum of the channels on P_{tot} = 1 W per chip (DO_x 0…7 = chip 1, DO_x 8…15 = chip 2), see picture 6 and 7.

$P_{tot} = P_0 + \ldots + P_7 \leq 1$ W (per chip by 70 ºC)

with $P_0 = I_{C0} \cdot U_{CE0}$



Picture 6: Collector current against saturation voltage



Picture 7: Collector current against duty cycle and number of active channels in use

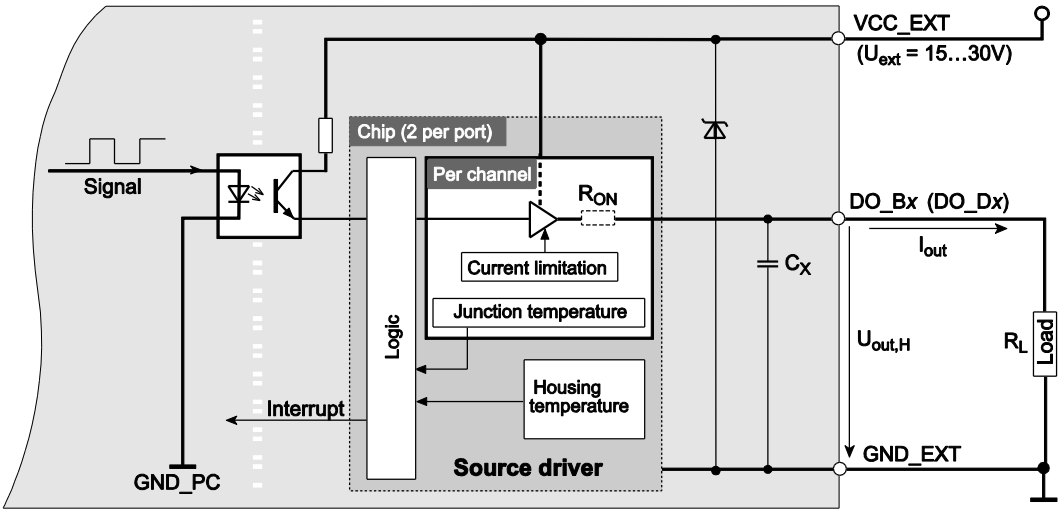
To supply the sink output drivers, an external power supply has to be connected to VCC_EXT (Pin 10, 20) with sufficient power (depending on the application). At full load this means min. 0.8 A for the ME-5820 and min. 1.6 A for the ME-5821.

3.4.2.2 Source Driver

Each input port is equipped with two source driver chips of type ISO1H811G; detailed specifications see page 29.

The source output drivers are short-circuit-proof and are equipped with a current limiting per channel. The combination of current limiting, thermal shutdown, and automatic restart protects the circuitry against overload.

In the case of an overload condition (T_{TSD} = typ. 175 °C) the related channel will switch off and on again automatically, as soon as the junction temperature has fallen below the threshold of T_R = 135 ºC. If a chip temperature of typ. 130 ºC is still exceeded, the overloaded channel remains disabled and is only reactivated, if the temperature decreases below T_{CR} = 110 ºC. Channels in standard (no overload) condition can be used at any time without restrictions. In the case of an overload condition the output driver (per port) can send an interrupt to the PC. A further security feature is a complete disabling of a port in case of a missing ground connection.



Picture 81: ME-5820/21 outputs with source drivers

The following table shows the maximum output current I_{Out} in dependency of the number of channels in use.

Number Of Channels Used	1	16	32
I_{OUT}[A]	0.625 A	0.370 A	0.180 A

Table 2: Max current of the source driver

To supply the source output drivers, an external power source has to be connected to VCC_EXT (pin 10, 20), with sufficient power (depending on

the application). At full load this means minimum 6 A for the ME-582x. The output voltage $U_{Out,H}$ can be calculated like this:

$U_{out,\,H} = U_{ext} - (R_{ON} \cdot I_{out})$

3.5 Frequency Input/Output

With the concept of “configurable subdevices” on the ME-5000 series boards you can use certain subdevices with an alternative functionality. The configuration tool ME-iDC is used to change the configuration before the user application is started.

The following channels are available:

- Frequency measurement (FI = “Frequency Input”):

  ME-5820 has 4, ME-5821 has 8 independent inputs for measurement of frequency and duty cycle of periodic rectangular signals (max. 300 kHz).

- Pulse generator (FO = “Frequency Output”):
  ME-5820 has 4, ME-5821 has 8 independent outputs for a periodic rectangular signal up to 3 kHz with a selectable duty cycle.

The related pins are marked with FI_x and FO_x in the pinout picture on page 24. The remaining I/O-channels of the digital-ports cannot be used in this configuration.

Note: For the configuration “pulse generator” (FO) take care of the level at the unused pins DO_B4..15 (ME-5820) and DO_D4..15 (ME-5821). When used as sink drivers the channels are high impedance, when used as source drivers they are connected to ground!

The specifications of the digital-I/O ports also apply to the FI/FO lines. A reference to the ground of the external circuitry via GND_EXT (pins 9, 11, 59) has to be setup in any case.

The frequency counters and pulse generators are configured via software. Chapter 4.1 on page 22 describes the programming of the frequency-I/Os.

3.6 Counters

A standard counter chip of type 82C54 is emulated used on the ME-582x boards. This versatile chip has 3 independent 16-bit (downward) counters. All counter signals are available at the D-sub female connector.

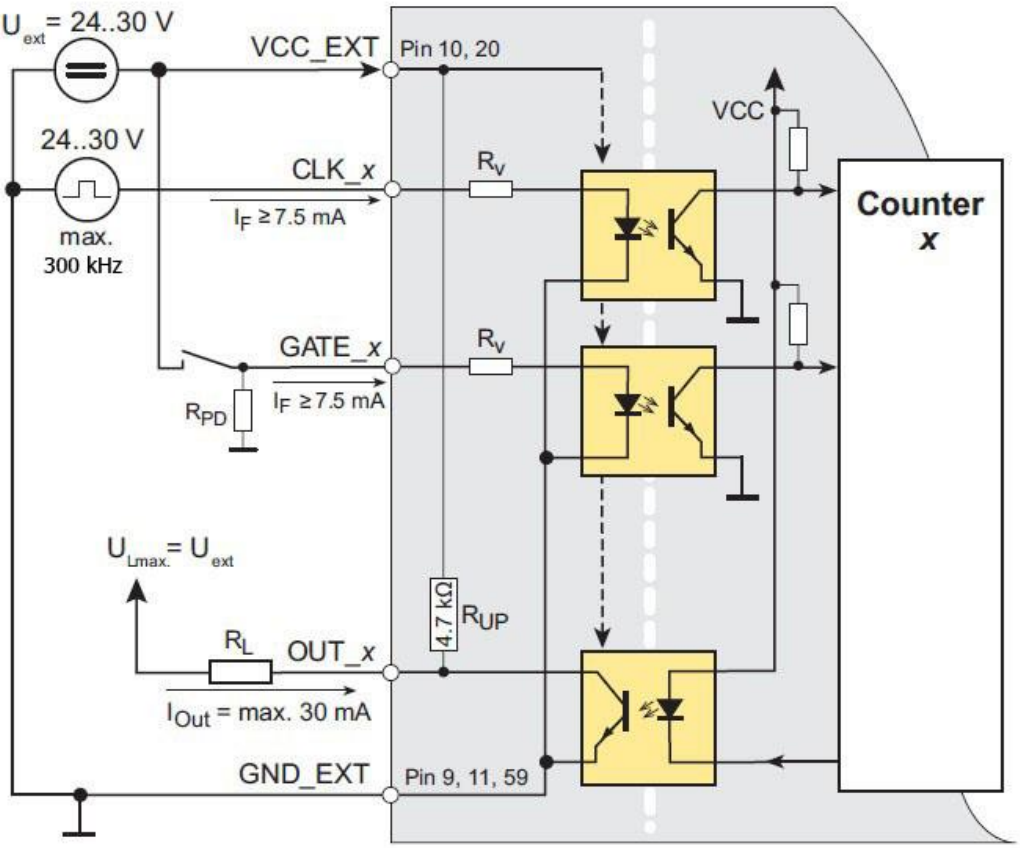
With a suitable enabling of the GATE input (0 V) the related counter will start downward-counting with negative edge control. The counter clock

(CLK) has to be supplied externally and can be max.300 kHz. With a suitable external wiring the counters also can be cascaded.

All counter signals (CLK, GATE, and OUT) are opto-isolated. The counter inputs have been designed for 24 V (R_V = 3 kΩ) as used in industrial control applications. When the counters are used, U_{ext} has to be in the range of 24…30 V. The counter outputs are equipped with pull-up resistors (R_{UP} = 4.7 kΩ).

For programming the timers see chapter 4.1 on page 22.

3.6.1 Wiring of the Counters



Picture 9: Wiring of the counters

Notes:

- Output OUT_2 is designed as an “Open Collector” output, i.e. as soon as the output is conducting (logic “1”), the load R_L is connected to ground (GND_EXT). Logic “0” means that the output is in a high-impedance state.
- The polarity of the input signals (CLK_x and GATE_x) is inverted by the opto-couplers.
- All counter signals require a reference to external ground GND_EXT (pins 9, 11, 59).

- The inputs CLK_x and GATE_x have been designed for a voltage level of +24 V (R_V = 3 kΩ).Note for I_F: 7.5 mA ≤ I_F ≤ 10 mA.
- The max. output current of opto-isolated versions may not exceed I_{Out} = 30 mA.

3.6.2 Pulse Width Modulation

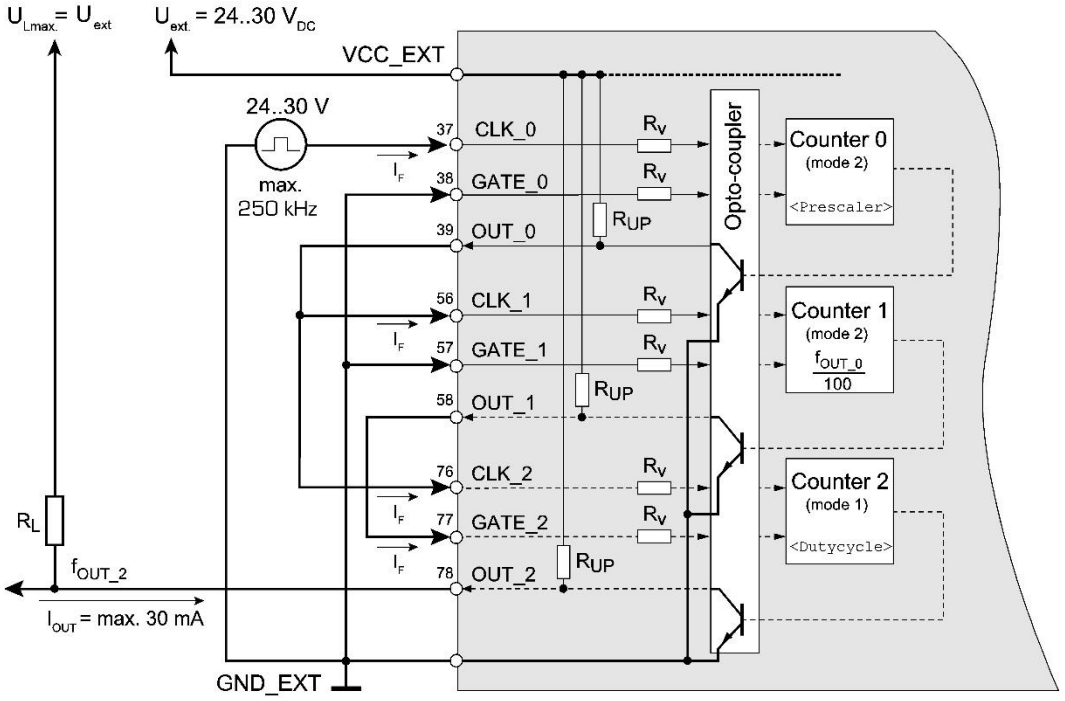
Pulse width modulation (PWM) is a special application of the counters. With a suitable external wiring a signal with variable duty cycle can be generated with the help of counters 0…2. The duty cycle can be varied in the range of 1…99 % in steps of 1.

The prescaler has to be sourced with an external base clock of max. 250 kHz. This results in a max. output signal frequency of 1,25 kHz. Picture 19 shows the external wiring to be used with the functions *meUtilityPWMStart/Stop* (see also ME-iDS manual).

$$f_{OUT\_2} = \frac{\text{Base clock}}{\text{<Prescaler>} \cdot 100} \quad (\text{with <Prescaler>} = 2\ldots(2^{16} - 1))$$

The following picture shows the external wiring of the counters for the ME-5820 series.

For programming the PWM output please read the ME-iDS user manual and the ME-iDS help file (see ME-iDS Control Center).



Picture 10: PWM wiring ME-5820 series

3.7 External Interrupt

If required, you can also monitor the bit-pattern of a digital input port. You can select one of the modes “bit-pattern change” and “bit-pattern compare”. As soon as the specified event occurs, an interrupt is issued and passed directly to the PC.

The digital inputs/outputs are programmed in the single operating mode. The interrupt handling is carried out with the *meIOIrq*… functions; see also chapter 4.3 on page 26.

4 Programming

For programming the device please use the Meilhaus Electronic Intelligent Driver System (ME-iDS) included in your package. The ME-iDS is a unique driver system covering different devices and operating systems. It supports Windows 7, 8.1 and 10 and contains a universal function library (API) for all common programming languages (the extent of the current software support can be found in the README-files of the ME-iDS).

A detailed description of the functions can be found in the ME-iDS manual (see CD/DVD enclosed or online:
www.meilhaus.de/download/ME-iDS.

Further details regarding the assignment of the subdevices and device specific arguments can be found in the help file (help file format under Windows, *.chm) which can be accessed via the „ME-iDS Control Center“ in the info area of the task bar (as a rule in the lower right corner of the screen) or via the Windows start menu.

ME-5820 board is a device with five subdevices, ME-5821 with seven sub-devices beginning with index “0”.. The functionality of the subdevices can be selected by the user from a list of predefined configurations. The desired configuration has to be selected with the configuration tool ME-iDC before the user application is started. With the standard configuration (ID 0) the board is ready to-use at once. The following tables show an overview of the configurations available:

ME-582x

Subdevice of Type	…Subtype	I/Os	ID of the Configuration
Subdevice 0 (DI, FI)			
Digital input (DI)	single	16-bit port	0*
Frequency input (FI)	single	4 channels	1
Subdevice 1 (DO, FO)			
Digital output (DI)	single	16-bit port	0*
Frequency output (FI)	single	4 channels	1
Subdevice 2…4 (Counters, Type 8254)			
3 x Counter (CTR)	single	3 x 16 bit	0*

Table 3: Subdevice configuration ME-582x:

Additionally for ME-5821

Subdevice of Type	…Subtype	I/Os	ID of the Configuration
Subdevice 5 (DI, FI)			
Digital input (DI)	single	16-bit port	0*
Frequency input (FI)	single	4 channels	1
Subdevice 6 (DO, FO)			
Digital output (DO)	single	16-bit port	0*
Frequency output (FO)	single	4 channels	1

Table 4: Subdevice configuration ME-5821 only

*Standard configuration at shipment. The most recently selected configuration in the ME-iDC is stored in a non-volatile memory on the board, and is automatically loaded after a restart.

Depending on your application you can choose one of the following operating modes:

- **Single:** In this mode single values can be read or written.
- **Interrupt:** For interrupt processing in the modes bit-pattern change and bit-pattern compare (see chapter 4.3.1 from page 27).

Operating Mode	Speed	Trigger
Single	Single value	Input/output by software
Interrupt (Bit-pattern detection)	$f_{IRQmax.}$ = 10 kHz	Ext. trigger signal at a digital-I/O port

Table 5: Operating modes overview

Detailed timing pictures can be found in the ME-iDS manual.

4.1 Single Operation Mode

Individual values can be read or written in this operating mode.

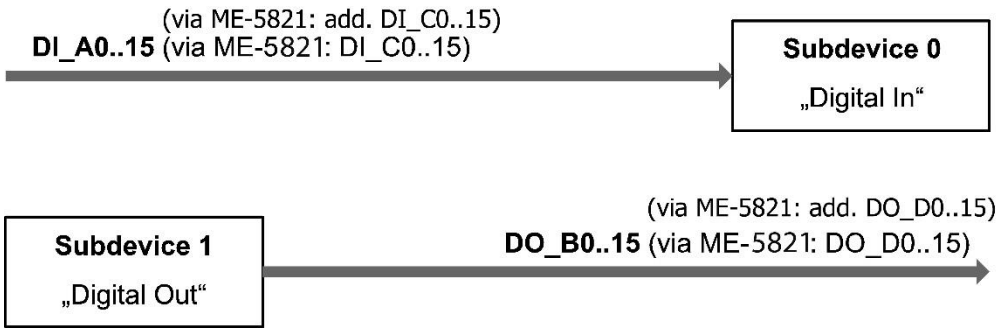
Notes:

- The digital-I/O channels direction is determined by the ME-582x hardware (opto-couplers).
- In power-down state and after switching on the PC all outputs are in a high-impedance state. Only if “1” is written, the output changes to conductive.
- A port that is configured as an output can also be read back!

4.1.1 Digital Input/Output

ME-5820	ME-5821
✓	✓

For input/output of individual digital values the single operation mode is used. The subdevices are defined as follows: subdevice 0 of the ME-5820 and additional subdevice 5 for ME-5821 always are the type ME_TYPE_DI and subdevice 1 and respectively subdevice 6 (ME5821) of type ME_TYPE_DO. The subtype of the subdevice is ME_SUBTYPE_ SINGLE.



Picture 11: Digital input/output in single operation mode

Please observe the ME-iDS manual and the ME-iDS help file (*.chm) for the procedure. You can open both these documents through the “ME-iDS Control Center) or through the Windows Start menu.

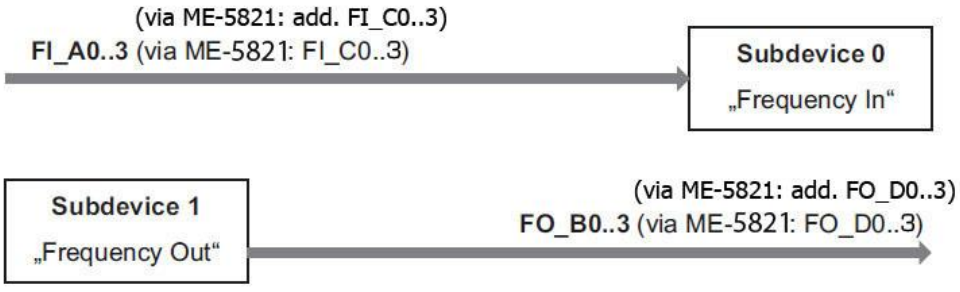
Please read chapter 3.5 on page 12 for the wiring of the digital ports.

4.1.2 Frequency Input/Output

ME-5820	ME-5821
✓	✓

Before you can use the "Frequency measurement" or "Pulse generator" modes, it is necessary, before opening your application, to run the ME-iDC configuration tool in order to specify the configuration for the corresponding subdevice (see also Table 3 on page 21).

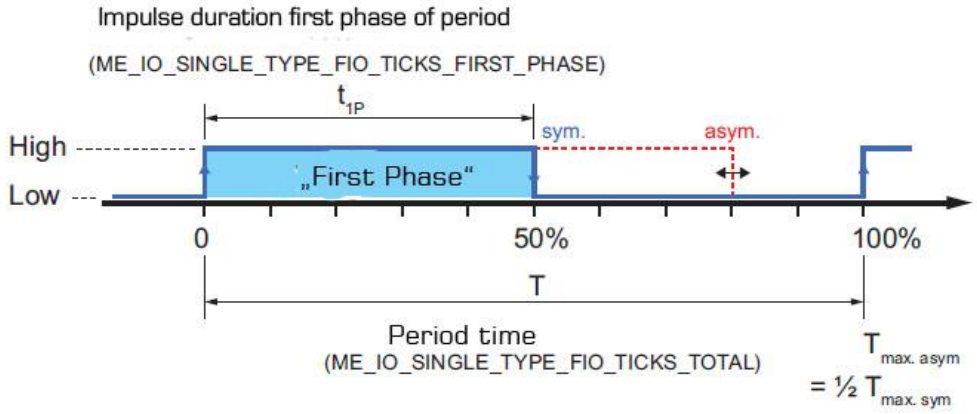
The programming of the frequency measurement and the pulse generator is always done in the single operation mode. The subtype of the subdevices is always ME_SUBTYPE_SINGLE.



Picture 122: Frequency input/output in single operation mode

Please read the ME-iDS manual and the ME-iDS help file (*.chm) carefully prior to programming. You can open both of these documents through the "ME-iDS Control Center" or through the Windows Start menu.

Two variables are introduced to describe the rectangular signal, and apply equally to input and output. One value indicates the period T, while the other value provides the duration of the pulse of the first phase of the period t_{1P}. For frequency measurement, the measurement starts with the first rising edge, and finishes with the next rising edge. The falling edge that lies between them defines the end of the first phase. In pulse generator mode, output normally starts with a high level, changing to the low level when the first phase has elapsed.



Picture 133: Signal definition

The time reference is provided by a 66 MHz counter. It is configured using the *meIOSingleConfig()* function. A period of 15.15 ns follows from this, and is defined as the smallest unit of time. It is referred to below as "1 tick". The resolution for T and t_{1P} is therefore 1 tick (see also the specifications on page 29).

Note that the value of the maximum period $T_{max.}$ depends on the duty cycle. A distinction is drawn between rectangular signals with an asymmetrical duty cycle $T_{max.\ asym.}$ and a symmetrical duty cycle $T_{max.\ sym.}$.

The figures for the ME-5820 series are:

$T_{max.\ asym.}$ = 16.25 s (0.06 Hz); $T_{max.\ sym.}$ = 32.5 s (0.03 Hz)

The wiring of the frequency inputs/outputs can be found in chapter 3.6 on page 16.

4.1.2.1 Frequency Measurement

With the frequency measurement operating mode (FI= "Frequency In-put") you can determine the period or frequency, and the duty cycle of rectangular signals up to 300 kHz. The resolution is 1 tick = 15.15 ns. The measurement always starts at a rising edge. On the ME-5820, all 4 frequency measuring channels (FI_A0…3) are addressed as subdevices of type

ME_TYPE_FI, subtype ME_SUBTYPE_SINGLE. Each channel can be programmed independently.

With the ME-5821 board, 4 additional frequency measurement channels (FI_C0…3) are available which can be addressed as one subdevice.

Note: If the frequency and duty cycle are the magnitudes you want, these can easily be calculated from the values returned for `<pdTime>`. The formula is:

Frequency [Hz] = 1/period [s]

Duty cycle [%] = („duration of the first phase of the period“[s]/ period [s] x 100

4.1.2.2 Pulse Generator

In the pulse generator operating mode (FO = "Frequency Output") you can output rectangular signals with a variable duty cycle at frequencies of up to 3 kHz and with a resolution of 1 tick. On the ME-5820, all 4 pulse generator channels (FO_B0…3) are addressed as subdevices of type ME_TYPE_FO, subtype ME_SUBTYPE_SINGLE. Each channel can be programmed independently.

The first phase of the rectangular signal is "high" by default. By setting the ME_IO_SINGLE_TYPE_FO_START_LOW flag it is also possible to start the output with a "low" level.

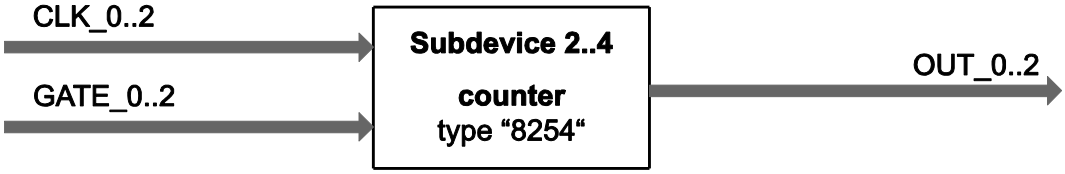
With the ME-5821 board, 4 additional pulse generators (FO_D0…3) are available, addressed as one subdevice.

Note: An output channel can also be read back!

4.1.3 Counters (8254)

ME-5820	ME-5821
✓	✓

The programming of the counters is done in operation mode „Single“. A counter device of type 82C54 provides three 16-bit counters. Each counter is accessed as a subdevice of type ME_TYPE_CTR, subtype ME_SUBTYPE_CTR_8254. **Note** the order of operation as described in the ME-iDS manual and in the ME-iDS help file (see ME-iDS Control Center).



Picture 14: Counter in Single

4.1.3.1 Standard Operation Modes

The counters can be configured independently of one another by the function *meIOSingleConfig()* for the following 6 operation modes (a detailed description of the modes can be found in the ME-iDS manual):

- Mode 0: Change state at zero
- Mode 1: Retriggerable „One Shot“
- Mode 2: Asymmetric divider
- Mode 3: Symmetric divider
- Mode 4: Counter start by software trigger
- Mode 5: Counter start by hardware trigger

Please read picture 9 on page 17 for the wiring of the opto-isolated counter signals.

4.1.3.2 Pulse Width Modulation

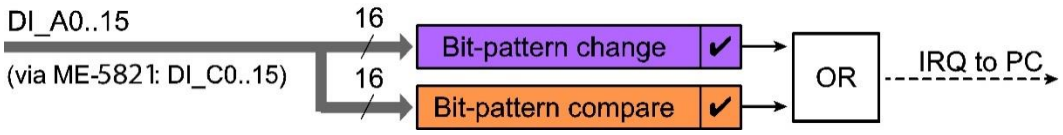
With the wiring shown in picture 10 on page 19 you can simplify programming considerably using the functions *meUtilityPWMStart!Stop* for this operation mode (see also ME-iDS manual and ME-iDS help file).

4.2 Interrupt Operation

ME-5820	ME-5821
✓	✓

With the ME-582x you can monitor the bit-pattern of the 16-bit-wide input ports of subdevice 0 of the ME-5820 board (DI_A0..15) as well as subdevice 5 additionally of the ME-5821 board (DI_C0..15). Depending on the application you can select one of the operating modes “bit-pattern compare” and “bit-pattern change”. As soon as the first edge that meets the trigger condition arrives, an interrupt is issued and passed directly to the PC.

Programming the digital input/output is carried out in the operation mode single. The subdevice must have the type ME_TYPE_DI. The interrupt processing is controlled with the functions *meIOIrq*…



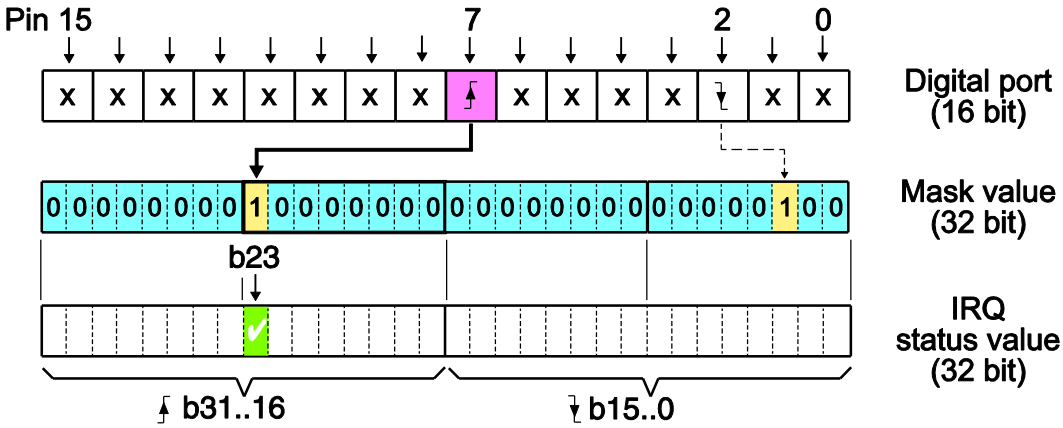
Picture 154: Interrupt options

Please observe the ME-iDS manual and the ME-iDS help file (*.chm) for the procedure. You can open both of these documents through the “ME-iDS Control Center” or through the Windows Start menu.

4.2.1 Bit-Pattern Change

In the bit-pattern change mode, one or more bits that are to be monitored for a change of state can be defined (masked). A 32-bit-wide argument per subdevice contains the mask. For each input pin both one bit for rising edge and one bit for falling edge is available. If the state of at least one bit masked with a "1" changes (0 → 1 or 1 → 0), an interrupt is issued (see picture 16 on page 27).

In what is known as the "extended format" of interrupt handling (see the ME-iDS manual), two bits are available for the interrupt status of each pin. One is for the rising edge, and one for the falling edge. The bits for the falling edges are assigned to the bit b 15…0, while the bits for the rising edges are assigned to the bits b 31…16.



Picture 16: Bit-pattern change

Example (see picture 16):

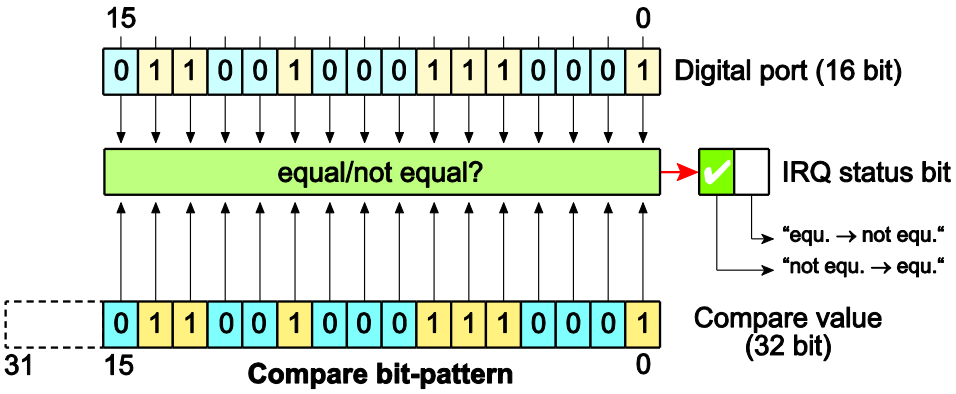
By writing the value 0x00800004 Hex as a mask value (see parameter `<iIrqArg>` of the function *meIOIrqStart()*), bit 2 is monitored for a falling edge, and bit 7 for a rising edge. A rising edge now is to arrive at bit 7, so that an interrupt is issued and in the interrupt status value bit b 23 returns

"1". Any edges that might arrive at pins labelled with an "X" are ignored. Only the change in state of a pin whose edge is set to "1" in the parameter `<iIrqArg>` can issue an interrupt.

The interrupt event is evaluated with the function *meIOIrqWait().* We recommend using what is known as the "extended format" to obtain detailed information about the triggering edge.

4.2.2 Bit-Pattern Compare

In the “bit-pattern compare” mode, the bit-pattern of digital inputs can be monitored for equality or inequality. The compare bit-pattern of the corresponding subdevice is used as reference. If the state changes from unequal to equal or from equal to unequal, an interrupt is generated (see picture 17 on page 28).



Picture 17: Bit-pattern compare

5 Appendix

A Specification

(Ambient temperature 25 °C)

PC Interface

PCI-Express Bus	PCI-Express x1, Version 2.0
PXI-Express Bus	PCI-Express x1, Version 2.0, PICMG 2.0 R3
Plug&Play	is fully supported

Digital Input/Output (general)

Measured Quantity/Criterion	**Condition/Explanation**	**Value**
Ports ME-582x	subdevice 0 (Single)	16-bit input port opto-isolated
	subdevice 1 (Single)	16-bit output port opto-isolated
Ports ME-5821 (only)	subdevice 5 (Single)	16-bit input port opto-isolated
	subdevice 6 (single)	16- bit output port opto-isolated
Operation modes	single	software triggered read/write
	interrupt	bit-pattern change, bit-pattern compare
Frequency input signal	symmetrical rectangular signal	max. 300 kHz
Frequency output signal	symmetrical rectangular signal	max. 3 kHz
	option „wraparound“	max. 3 kHz, without load for the Host PCs
Timer (CHAN-time)	input	30.30 ns…65 s (2..FFFFFFFFHex Ticks)
	output	0.15 ms…65 s (11000..FFFFFFFF-Hex Ticks)

Timer resolution	programmable	15.15 ns (1 Tick)
Input level	see the following tables	
Isolation voltage	U_{ISO} (f = 60 Hz, t = 60 s)	max. 1000 VAC_{rms}
Reference ground	isolated from PC ground	GND_EXT

Opto-Isolated Inputs

Static values

Conditions: TA=25 °C

Measured Quantity	**Test Criterion**	**MIN**	**Type**	**MAX**	**Unit**
$U_{in,H}$		5		60	V
$U_{in,L}$		0		2.2	V
R_{in}	U_{in}=24 V		4.3		kΩ
I_{in}	U_{in}=24 V		5.5	6	mA

Limiting Values

Measured Quantity /Criterion	**Condition/Explanation**	**Value**
URWM over-voltage protection for inputs	max. 600 W pulse power at a pulse width of 1 ms	64.4 V

Opto-Isolated Outputs

Conditions: T_A=25 °C

Output-drivers	sink	2 x ULN2803 (ME-5820)
		+ 2 x ULN2803 (ME-5821)
	source	2 x ISO1H811G (ME-5820)
		+ 2 x ISO1H811G (ME-5821)
External supply	U_{ext}	15…30 V
	U_{Lmax}	U_{ext}

For further specifications see chapter sink driver resp. source driver

Sink Driver (UDN2803)

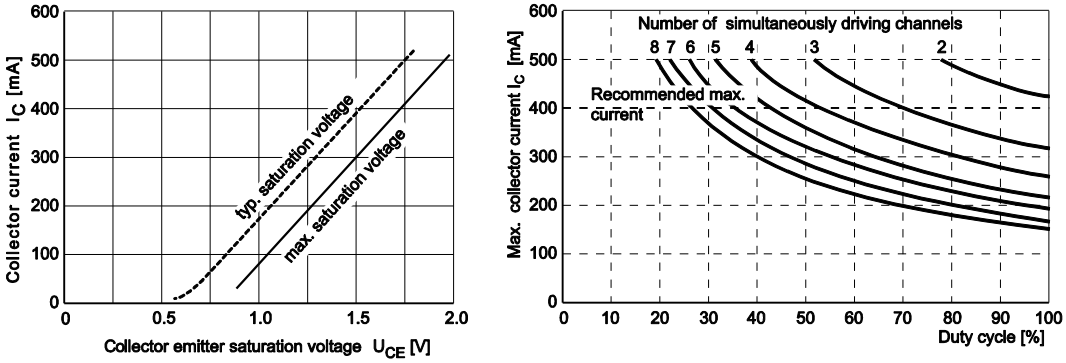
Measured Quantity	**Test Criterion**	**MIN**	**Type**	**MAX**	**Unit**
I_{OUT} =I_C (output current)	per channel			50	mA
	See also characteristics curves in picture 18				

I_{CEX} (output leckage current)	U_{CE}=50 V, T_A=25 °C U_{CE}=50 V, T_A=85 °C			50 100	µA
$U_{CE(SAT)}$((collector emitter saturation voltage)	I_{OUT}=350 mA I_{OUT}=200 mA I_{OUT}=100 mA		1.3 1.1 0.9	1.6 1.3 1.1	V
I_R (clamp diode reverse current)	U_R=50 V, T_A=25 °C U_R=50 V, T_A=85 °C			50 100	µA
U_F (clamp diode forward voltage)	I_F=350 mA			2.0	V
t_{on} (switch-on time)	R_L=125 Ω, U_{OUT}=50 V, C_L=15 pFina		0.1	1	µs
t_{off} (switch-off time)	R_L=125 Ω, U_{OUT}=50 V, C_L=15 pF		0.2	1	µs

Output current

The maximum current per output (I_C) depends of the saturation voltage U_{CE} and is limited by the power dissipation of the sum of the channels to P_{tot}=1 W per chip:

$P_{TOT}=P_0+\ldots+P_7$ ≤1 W (by 70 °C)



Picture 18: Characteristic curves UDN2803

Source Driver (ISO1H811G)

(short-circuit proof with current limiting and temperature monitoring)

Voltage supply

Conditions: U_{ext}=15…30 V, TJ=-25…+125 °C

Measured Quantity	**Test Criterion**	**MIN**	**Type**	**MAX**	**Unit**
U_{OUT}	U_{ext}=24 V; 1 channel with I_{out}=0,625 A		23.8		V
I_{OUT}/channel	1 channel			625	mA

	16 channel			370	mA
	32 channel (with ME-5002)			180	mA
U_{USD} (undervoltage shutdown)		7		10.5	V
R_{ON} (resistance if output active)	I_{OUT}=0.5 A, TI=25 °C I_{OUT}=0.5 A, TJ=125 °C		150 270	200 320	mΩ mΩ
I_S (current consumption driver chip)	8 channels active per chip; without load		10	14	mA
$I_{L(off)}$ (output current in inactive state)	U_{in}=U_{OUT}=0 V,	0	5	30	µA

Switching Times

Measured Quantity	**Test Criterion**	**MIN**	**Type**	**MAX**	**Unit**
t_{on} (switch-on time)	RL=47 Ω, to 90 % U_{out}		64	120	µs
t_{off} (switch-off time)	RL=47 Ω, to 10 % U_{out}		89	120	µs
$dU_{out}/dt_{(on)}$ (slope on switch-on)	RL=47 Ω, up 10…30 % U_{out}, U_{ext}=15 V		1	2	V/ µs
$dU_{out}/dt_{(off)}$ (slope on switch-off)	RL=47 Ω, up 70…40 % U_{out}, U_{ext}=15 V		1	2	V/ µs

Limiting Values

Measured Quantity	**Test Criterion**	**MIN**	**Type**	**MAX**	**Unit**
T_{CSD} (housing switch-off temperature)		125	130	135	°C
T_{CR} (housing reset temperature)		110			°C
T_{TSD} (junction switch-off temperature)		150	175	200	°C
T_R (junction reset temperature)		135	1		°C
I_{lim} (DC-short-circuit current)	U_{ext} = 24 V, R_L=10 mΩ		1.1		A

Frequency Input/Output

Availability	alternative subdevice configuration via ME-iDC
Signal-form	rectangular

Frequency Measuring Channels

Measured Quantity/Criterion	**Condition/Explanation**	**Value**
Reference ground	isolated from PC ground	GND_EXT
Number of channels	ME-5820 (FI_A0…3)	4 inputs (opto-isolated)
	ME-5821 (FI_A0…3) and (FI_C0…3)	8 inputs (opto-isolated)
Input-level		see digital I/O
Input-current		see digital I/O
Period (T)	$T_{min.}$ =$T_{min.asym.}$=$T_{min.sym.}$ $T_{max.asym}$ $T_{max.sym}$	3.3 µs (300 kHz) 16.25 s (0.06 Hz) 32.5 s (0.03 Hz)
Duty-cycle	variable, depending on T	measurable in steps of 1 tick
Resolution	1 tick	15.1$\overline{5}$ ns
Accuracy		± 15.15 ns
Operating modes		single

Pulse Generator Channels

Measured Quantity/Criterion	**Condition/Explanation**	**Value**
Reference ground	isolated from PC ground	GND_EXT
Number of channels	ME-5820 (FI_A0…3)	4 outputs (opto-isolated)
	ME-5002 (FI_A0…3) and (FI_C0…3)	8 outputs (opto-isolated)
Output level	sink or source driver	see digital I/O
Period (T)	$T_{min.}$ = $T_{min.asym.}$=$T_{min.sym.}$ $T_{max.asym}$ $T_{max.sym}$	0.3$\overline{3}$ ms (300 kHz) 16.25 s (0.06 Hz) 32.5 s (0.03 Hz)
Duty-cycle	variable, depending on T	to be set in steps of 1 tick
Resolution	1 tick	15.1$\overline{5}$ ns
Accuracy		± 15.1$\overline{5}$ ns

Operating modes		single

Counters

Number	3 x 16 bit (1 x 82C54)
Opto-isolation	yes (dimensioning of the I/O level for 24 V)
Counter-clock	up to 300 kHz by external source

…with Opto-Isolation

Measured Quantity/Criterion	**Condition/Explanation**	**Value**
Reference ground	isolated from PC ground	GND_EXT
External supply for opto-couplers	U_{ext}	24…30 V
Level for Counter Outputs (OUT_x)		
Type		“Open Collector”
U_{Lmax}		U_{ext}
I_{Out}		max. 30 mA
Level for Counter Inputs CLK_x, Gate_x)		
Logic level	inverted by opto-couplers	low-active
I_F		7.5 mA ≤ I_F ≤ 10 mA
U_{IL}		max. 0.8 V
U_{IH}		24..30 V, max. U_{ext}

Interrupt

Measured Quantity/Criterion	**Condition/Explanation**	**Value**
Interrupt sources	passed directly to the PC	bit-pattern change bit-pattern compare

General Data

Measured Quantity/Criterion	**Condition/Explanation**	**Value**
Power supply	PXI-Express	+3,3 V (via PXIe-Bus)
	PCI-Express	+3.3 V (via PCIe-Bus)
	PXI-Epress	0.8…1.2 A (full-load)

Current consumption	PCI-Express	0.8…1.2 A (full-load)
Board dimensions (without slot bracket and connector)	PXI-Express	3 U PXI-Express board
	PCI-Express	162 mm x 98 mm
Connections	ST1	78-pin D-sub female socket
Operating temperature		0 °C…70 °C
Storage temperature		-40 °C…100 °C
Air humidity		20 %…55 % (non-condensing)
Certification	CE	

B Pinout

Note: „ME-581x“ represents all models of the ME-5820 series.

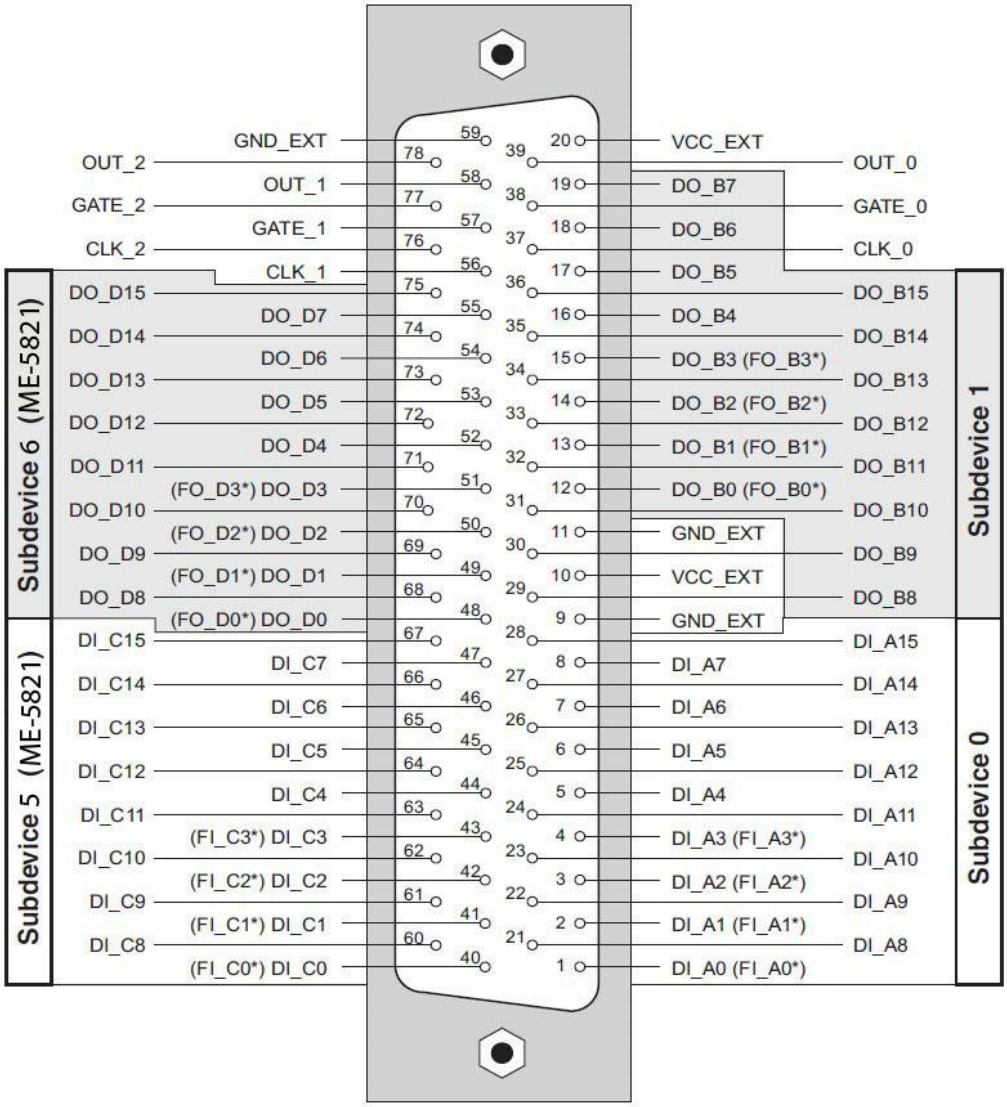
Legend for pinouts:

Name	Function
DI_A0..15	digital inputs of ME-582x (subdevice 0)
DO_B0..15	digital outputs of ME-582x (subdevice 1)
DI_C0..15*	digital inputs of ME-5821 (subdevice 5)
DO_D0..15*-	digital inputs of ME-5821 (subdevice 6)
CLK_0..2	clock inputs for counters
GATE_0..2	gate inputs for counters (low-active)
OUT_0..2	Counter outputs (type "Open-Collector")
FI_A0..3	frequency measurement inputs of ME-582x (subdevice 0, alternative configuration)
FO_B0..3	pulse generator outputs of ME-582x (subdevice 1, alternative configuration)
FI_C0..3*	frequency measurement input of ME-582x (subdevice 5, alternative configuration)
FO_D0..3*	pulse generator output of ME-5821 (subdevice 6, alternative configuration)
VCC_EXT	VCC input for ext. power supply of isolated ports, U_{ext} typ. 24 VDC
GND_EXT	reference ground for isolated ports (isolated from PC ground)

Note: In the configuration “pulse generator” (FO) do not forget to take care of the unused pins DO_B4..15 (ME-582x) and DO_D4..15 (ME-5821). When used as sink drivers they are in high-impedance state, when used as source drivers they are connected to ground!

*These signals are only available on ME5821

B1 78-pin D-Sub (ST1) — ME-582x



Picture 19: 78-pin D-sub female connector ME-582x

*These pins can only be used as frequency measurement inputs (FI_x) resp. pulse generator outputs (FO_x) after appropriate configuration of the corresponding subdevice with the ME-iDC. The remaining pins of the digital ports cannot be used for digital-I/O.

C Accessories

We recommend to use high-quality connector cables with single-shielded lines per channel.

For further accessories please refer to the current Meilhaus Electronic catalog and the internet:
www.meilhaus.de/en/pc-boards/accessories/

D Technical Questions

D1 Hotline

Should you have questions or inquiries concerning your Meilhaus device, please contact us:

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D-82239 Alling

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Tel.: (08141) 52 71 – 0
Fax: (08141) 52 71 – 129
eMail: sales@meilhaus.de

Support:
Tel.: (08141) 52 71 – 188
Fax: (08141) 52 71 – 169
eMail: support@meilhaus.de

Download-Server and Driver Update:
To download current driver versions for Meilhaus Electronic devices as well as manuals in PDF format, please go to:
www.meilhaus.org/driver

Service Department with RMA Process:
In case you need to return a board for repair purposes, we strongly ask you attach a detailed description of the error as well as information regarding your computer/system and the software used. Please register online using our RMA process:
www.meilhaus.de/en/infos/service/rma.htm.

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