



SPECTRUM

SYSTEMENTWICKLUNG MICROELECTRONIC GMBH

MC.70xx - 64 bit fast Digital I/O with TTL levels

- CompactPCI 6U format
- 1, 2, 4, 8 or 16 bit, 32 bit or 64 bit digital I/O
- 1 kS/s up to 125 MS/s at 16 and 32 bit
- 1 kS/s up to 60 MS/s at 32 and 64 bit
- 110 Ohm input impedance selectable
- 3.3 V and 5 V TTL compatible I/O
- Up to 512 MByte memory
- FIFO mode for input and output
- Pattern/Edge/Pulsewidth trigger
- Synchronization possible
- Windows program SBench 5.x included



Product range overview

| Model | 1-4 bit | 8 bit | 16 bit | 32 bit | 64 bit |
|--------|----------|----------|----------|----------|---------|
| ML7005 | 125 MS/s | 125 MS/s | 125 MS/s | | |
| ML7010 | | 125 MS/s | 125 MS/s | | |
| ML7011 | | 125 MS/s | 125 MS/s | 60 MS/s | |
| ML7020 | | 125 MS/s | 125 MS/s | 125 MS/s | |
| ML7021 | | 125 MS/s | 125 MS/s | 125 MS/s | 60 MS/s |

Software/Drivers

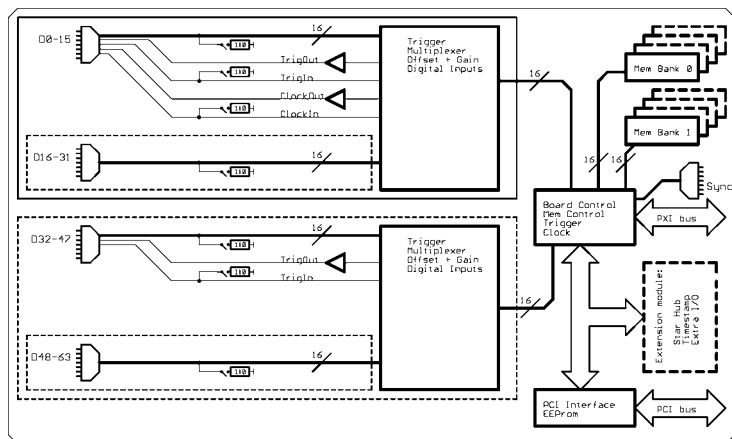
A large number of drivers and examples are delivered with the board or are available as an option:

- Windows 98/ME/NT/2000/XP - drivers
- Linux - drivers
- SBench 5.2
- Streaming Software SPviewIT 6.1 (as option, recording only)
- Microsoft Visual C++ examples
- Borland Delphi examples
- Microsoft Visual Basic examples
- Microsoft Excel examples
- LabWindows/CVI examples
- FlexPro support with SBench
- LabVIEW - drivers (as option)
- DASyLab - drivers (as option)
- MATLAB - drivers (as option)
- Agilent VEE - drivers (as option)

General Information

The MC.70xx series of fast digital I/O boards offer a resolution between 1 bit and 64 bit with a maximum samplerate of 125 MS/s (60 MS/s). Every 16 bit / 32 bit of the board could be separately programmed for input or output. The on-board memory of up to 512 MByte could be completely used for recording or re-playing digital data. Alternatively the MC.70xx could be used in FIFO mode. Then data is transferred on-line to PC memory or hard disk. The internal standard synchronisation bus allows synchronisation of several MC.xxxx boards. Therefore the MC.70xx board could be used as an enlargement to analogue boards.

Hardware block diagram



Software programmable parameters

| | |
|-----------------------------|--|
| Samplerate | 1 kS/s to max samplerate, external clock, ref clock |
| Direction | Input/Output for each module |
| Input impedance | 110 Ohm / 50 kOhm for each channel |
| Clock mode | internal PLL, int.quartz, external, ext. divided, ext. reference clock |
| Clock impedance | 110 Ohm / 50 kOhm |
| Trigger impedance | 110 Ohm / 50 kOhm |
| Trigger pulsewidth | 1 to 256 samples in steps of 1 |
| Trigger mode | Pattern and mask, edge, external TTL, software |
| Pattern and mask | 32 bit / 64 bit wide: 0 pattern, 1 pattern, don't care or edge |
| Memory depth | 32 up to installed memory in steps of 32 |
| Posttrigger | 32 up to 128 M in steps of 32 |
| Multiple Replay segmentsize | 32 up to installed memory / 2 in steps of 32 |

Application examples

| | | |
|----------------------|-----------------|---------------------|
| Semiconductor test | Production test | Pattern generator |
| A/D data acquisition | Logic analyser | Pattern recognition |

Possibilities and options

FIFO mode

The FIFO mode is designed for continuous data transfer between measurement board and PC memory (up to 100 MB /s) or hard disk (up to 50 MB/s). The control of the data stream is done automatically by the driver on interrupt request.

Pattern trigger

For every bit of the digital input the pattern trigger defines individually the expected level or sets the bit to „don't care“. In combination with pulsewidth counter and edge detection the pattern trigger could be used to recognise a huge variety of trigger events.

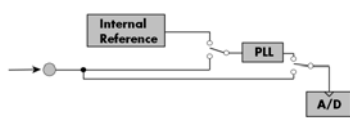
External trigger I/O

All boards could be triggered using an external TTL signal. It's possible to use positive or negative edge also in combination with a programmable pulsewidth. An internally recognised trigger event could - activated by software - routed to the output connector to start external instruments.

External clock I/O

Using an external connector a sampling clock could be fed in from an external system. It's also possible to put out the internally used sampling clock to synchronise external equipment to this clock.

Reference clock



The option to use a precise external reference clock (normally 10 MHz) is necessary to synchronise the board for high-quality measurements with external equipment (like a signal source). It's also possible to enhance the quality of the sampling clock this way. The driver automatically generates the requested sampling clock from the fed in reference clock.

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Cascading

The cascading option synchronises up to 4 Spectrum boards internally. It's the simplest way to build up a multi channel system. There is a phase delay between two boards of about 500 pico seconds when this synchronisation option is used.

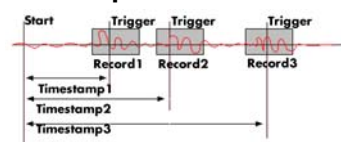
Star hub

The star hub is an additional module allowing the phase stable synchronisation of up to 16 boards. Independent of the number of boards there is no phase delay between all channels. The star hub distributes trigger and clock information between all boards. As a result all connected boards are running with the same clock and the same trigger.

Extra I/O

The Extra I/O module adds 24 additional digital I/O lines and 4 analog outputs on an extra connector. These additional lines are independent from the standard function and could be controlled asynchronously. There is also an internal version available with 16 digital I/Os and 4 analog outputs that could be used directly at the rear board connector.

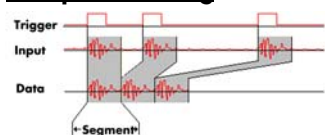
Timestamp



The timestamp option writes the time positions of the trigger events in an extra memory. The timestamps are relatively to the start of recording, to a defined zero time

or externally synchronised to a radio clock or a GPS receiver. With this option acquisitions of systems on different locations could be set in a precise time relation.

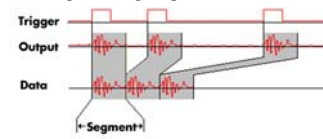
Multiple Recording



The Multiple Recording option allows the recording of several trigger events without restarting the hardware. With this option very fast repetition

rates could be achieved. The on-board memory is divided in several segments of same size. Each of them is filled with data if a trigger event occurs.

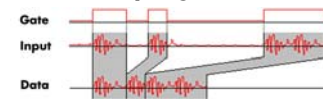
Multiple Replay



The Multiple Replay option allows the fast repetition output on several trigger events without restarting the hardware. With this option very fast repetition rates could be achieved.

The on-board memory is divided in several segments of same size. Each of them is generated if a trigger event occurs.

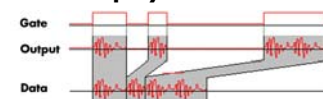
Gated Sampling



The Gated Sampling option allows data recording controlled by an external gate signal. Data is only recorded if the gate signal has a programmed level.

programmed level.

Gated Replay



The Gated Sampling option allows data replay controlled by an external gate signal. Data is only replayed if the gate signal has a programmed level.

med level.

Singleshot output

When singleshot output is activated the data of the on-board memory is replayed exactly one time. As trigger source one can use the external TTL trigger or the software trigger.

Continuous output

When continuous output is activated the data of the on-board memory is replayed continuously until a stop command is executed. As trigger source one can use the external TTL trigger or the software trigger.

1-4 bits mode

On the model 7005 it is also possible to use just 1, 2 or 4 bits for acquisition or replay. In 1 bit mode the 8 times higher memory is then available, at 2 bits mode it is 4 times higher and at 4 bits mode it is double. This enlarges the recording/replay time in on-board memory and it reduces the transfer rate when using FIFO mode.

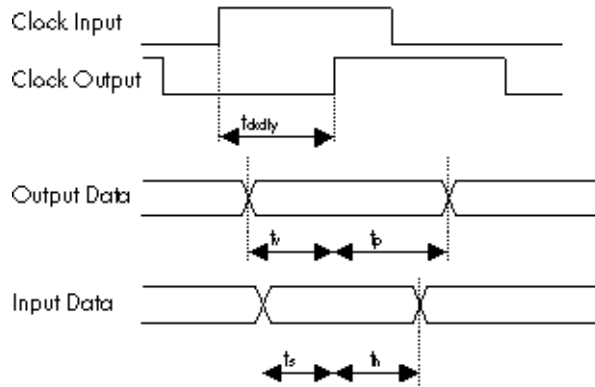
Technical Data

| | | | | | | | |
|---|---|---------|----------|----------------------------------|--|-------|-------|
| Internal samplerate | 1 kS/s up to 125 MS/s | | | Dimension | 160 mm x 233 mm (Standard 6U) | | |
| External samplerate | DC up to 125 MS/s | | | Width (MC.7005 MC.701x, MC.7020) | 1 slot | | |
| Input impedance | 110 Ohm / 50 kOhm 15 pF | | | Width (MC.7021) | 2 slots | | |
| 110 Ohm termination voltage | 2.5V | | | Connector | 40 pol half pitch (Hirose FX2 series) | | |
| Signal level (data, trigger, clock) | 3.3 V / 5 V TTL compatible | | | Operating temperature | 0°C - 50°C | | |
| | LOW | | HIGH | Storage temperature | -10°C - 70°C | | |
| Data input current sink (no termination) | 0.0 V | 3.3 V | 5.0 V | Humidity | 10% to 90% | | |
| | -1.0 µA | +1.0 µA | +20.0 µA | Trigger output delay | | | |
| Clock / trigger input current sink (no termination) | ± 1.0 µA | | | | | | |
| Multi: Trigger to 1st sample delay | fixed | | | | | | |
| Multi: Recovery time | < 20 samples (16 - 64 bit) | | | | | | |
| | 64 bit | 32 bit | 16 bit | 8 bit | 4 bit | 2 bit | 1 bit |
| ext. Trigger accuracy (samples) | 1 | 1 | 1 | 2 | 4 | 8 | 16 |
| int. Trigger accuracy (samples) | 1 | 1 | 1 | 2 | 4 | 8 | 16 |
| Trigger input: Standard TTL level | Low: -0.5 > level < 0.8 V High: 2.0 V > level < 5.5 V Trigger pulse must be valid ≥ 2 clock periods. | | | Clock input: Standard TTL level | Low: -0.5 > level < 0.8 V High: 2.0 V > level < 5.5 V Rising edge is used. Required duty cycle: 50% ± 5% | | |
| Trigger output | Standard TTL, capable of driving 50 Ohm. Low < 0.4 V (@ 20 mA, max 64 mA) High > 2.4 V (@ -20 mA, max -32 mA) One positive edge after the first internal trigger | | | Clock output | Standard TTL, capable of driving 50 Ohm Low < 0.4 V (@ 20 mA, max 64 mA) High > 2.4 V (@ -20 mA, max -32 mA) | | |

| Power consumption (maximum value) | Full speed | | | | Power down mode | | | |
|---|------------|----------------|-------|-------|-----------------|----------------|-------|-------|
| | +3,3 V | +5 V | +12 V | -12 V | +3,3 V | +5 V | +12 V | -12 V |
| MC.7005 (16 bit output @ 125 MS/s in 110 Ohm) | 0 A | 3.5 A (17.5 W) | 0 A | 0 A | 0 A | 1.5 A (7.5 W) | 0 A | 0 A |
| MC.7010 (16 bit output @ 125 MS/s in 110 Ohm) | 0 A | 3.5 A (17.5 W) | 0 A | 0 A | 0 A | 1.5 A (7.5 W) | 0 A | 0 A |
| MC.7011 (32 bit output @ 60 MS/s in 110 Ohm) | 0 A | 3.0 A (15.0 W) | 0 A | 0 A | 0 A | 1.5 A (7.5 W) | 0 A | 0 A |
| MC.7020 (32 bit output @ 125 MS/s in 110 Ohm) | 0 A | 4.9 A (24.5 W) | 0 A | 0 A | 0 A | 2.0 A (10.0 W) | 0 A | 0 A |
| MC.7021 (64 bit output @ 60 MS/s in 110 Ohm) | 0 A | 4.0 A (20.0 W) | 0 A | 0 A | 0 A | 2.0 A (10.0 W) | 0 A | 0 A |

For detailed information on the different modes for external clocking please refer to the dedicated chapter in the hardware manual for the boards of the 70xx series.

| Delay time | External Clocking Mode | | |
|-------------|------------------------|----------|----------|
| | SINGLE | BURST S | BURST M |
| t_{ckdly} | 20 ns | 30 ns | < 1 ns |
| t_v | > 350 ns | > 150 ns | > 2.5 ns |
| t_p | > 2.5 ns | > 2.5 ns | > 2.5 ns |
| t_s | ≤ 3.0 ns | ≤ 3.0 ns | ≤ 3.0 ns |
| t_{vh} | ≤ 1.0 ns | ≤ 1.0 ns | ≤ 1.0 ns |



Order information

| Order No | Description | Order No | Description |
|-------------|---|--------------|---|
| MC7005 | MC.7005 with 16 MByte (128 MBit) memory, cables and drivers | MC7xxx-32M | Option: 32 MByte memory instead of 16 MByte standard mem |
| MC7010 | MC.7010 with 16 MByte (128 MBit) memory, cables and drivers | MC7xxx-64M | Option: 64 MByte memory instead of 16 MByte standard mem |
| MC7011 | MC.7011 with 16 MByte (128 MBit) memory, cables and drivers | MC7xxx-128M | Option: 128 MByte memory instead of 16 MByte standard mem |
| MC7020 | MC.7020 with 16 MByte (128 MBit) memory, cables and drivers | MC7xxx-256M | Option: 256 MByte memory instead of 16 MByte standard mem |
| MC7021 | MC.7021 with 16 MByte (128 MBit) memory, cables and drivers | MC7xxx-512M | Option: 512 MByte memory instead of 16 MByte standard mem |
| MC7xxx-smod | Star Hub: Synchronisation of 2 - 16 boards, one option per system | MC7xxx-up | Additional handling costs for later memory upgrade |
| MC3xxx-time | Timestamp option: Extra memory for trigger time | MC7xxx-mr | Option Multiple Recording/Replay: Memory segmentation |
| MCxxxx-xmf | Extra I/O, external connector: 24 DI/O, 4 Analog out, incl. cable | MC7xxx-gs | Option Gated Sampling: Gate signal controls acquisition/replay |
| MC70xx-dl | DASYLab driver for MC.70xx series | MC7xxx-cs | Synchronisation of 2 - 4 boards, one option per system |
| MC70xx-hp | VEE driver for MC.70xx series | MCxxxx-dcab | Additional 40 pole flat ribbon cable with IDC socket connector, ca. 1 m |
| MC70xx-lv | LabVIEW driver for MC.70xx series | MCxxxx-dcab2 | Additional 40 pole flat ribbon cable withFx2 connector, ca. 1 m |
| MATLAB | MATLAB driver for all Ml.xxxx, MC.xxxx and MX.xxxx series. | | |