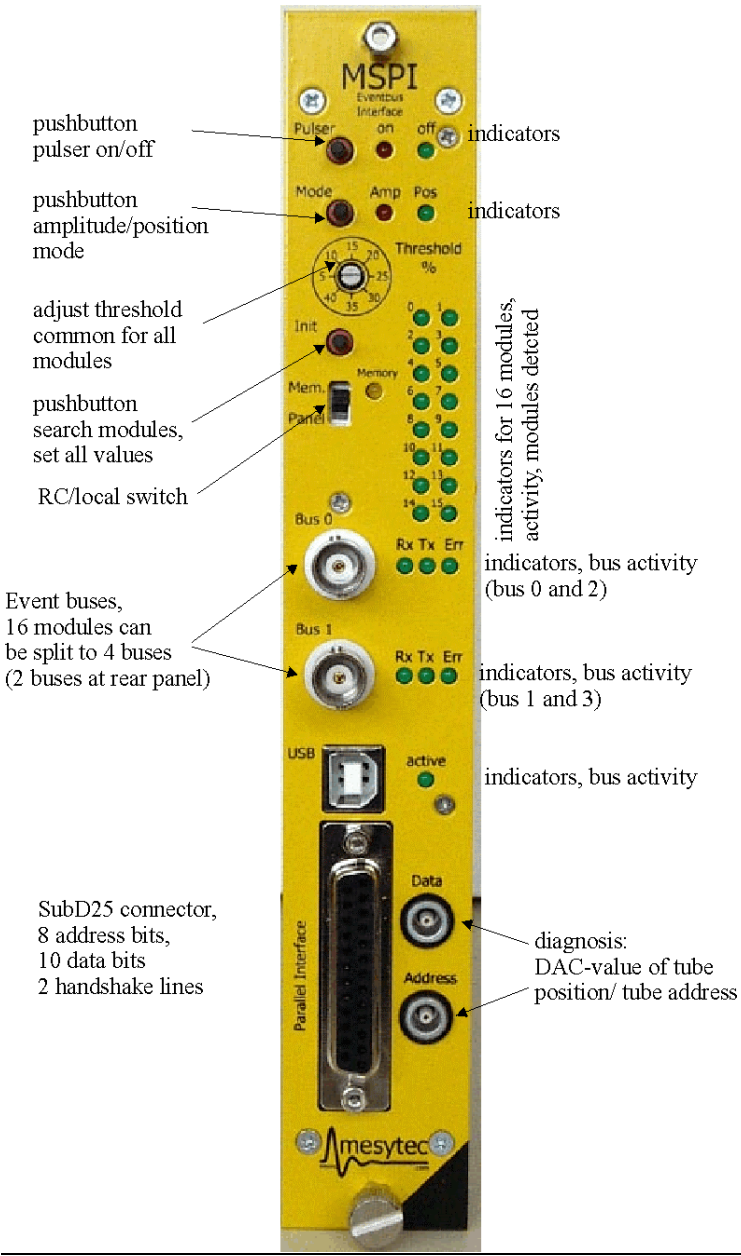
MSPI

Eventbus to Parallel Interface and Remote Controller

mesytec MSPI is a parallel interface and controller unit for frontend devices connected over the highspeed serial event bus. It provides the possibility to control all internal settings of the connected modules.
It interfaces up to 16 MPSD-8 or MSTD-16 devices on up to four eventbus branches to a parallel output for external data acquisition systems and histogrammers. Data are presented unbuffered in real time to allow time of flight measurements.
Basic features of the connected modules like pulser mode, amplitude/position mode and common threshold can be controlled via front panel elements. The RS232 and USB interfaces allow detailed adjustments of frontend channels. Up to 128 position sensitive or 256 standard tubes can be handled.



Rear panel elements

- RS232 connector for remote control,
- eventbus 2 and 3 in/out.

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Setup

Bus Connection:
All frontend modules are connected via the serial event bus. Bus medium is a standard RG58 coaxial cable, devices are connected with BNC t-pieces. The MSPI has to be one end of the bus, the other end has to be terminated with 50 Ohms. A total of 16 modules (MPSD-8 or MSTD-16) can be connected with the MSPI using from one to four buses. For maximum speed, a symmetric busload is suggested.

Addressing:
Each frontend electronics module has an address selector switch that allows selection of one out of 16 hexadecimal address (0…9 and A…F).
Please make sure that each address is unique for the MSPI (not only for the bus!). A blinking Status LED will signalise an address conflict.

Operation

Frontpanel operation:

Basic features of the frontend electronics can be directly accessed by frontpanel elements:

- Operating mode (Position/Amplitude)
- Common threshold
- Initialization
- Pulser test

Furthermore, the frontpanel allows to perform a detailed, prerecorded setup script (which can be entered and saved over the serial connection), e.g. to enable individual channel settings if necessary.

Modes:
There are two modes for MPSD-8 modules which can be toggled by a pushbutton:

1) Position mode (default setting):
   data represent the calculated 10 bit position.
   This is the mode for position resolved neutron measurements.
2) Amplitude mode:
   data represent 10 bit amplitude signals.
   Useful for diagnosis and detailed setup of HV, gain and threshold.

Position mode is the power up default mode.

Pulser:
MPSD-8 and MPSD-16 have integrated test pulsers for diagnosis. They can be activated by pushbutton. The pulser cycles through all connected channels in left / middle / right position (in position mode) or high / medium amplitude. This allows an easy check for electronic functionality.

Threshold
The common threshold for all the connected channels can be set with this coder. The usual setting is 20..25%, but for sensitive applications or high gamma background, it can also be set higher to get better suppression off gamma-hits in the tubes.

Gain
The total gain is a product of amplifier amplification and electron multiplication in the detector tube gas.
For standard use, without remote control, the amplifier gain is set to the mean value. The signal amplitude is adjusted via high voltage of the tubes.
With RS232 and USB control, the individual gains can be varied by a factor of ~ 4.

Init
If something is changed in the setup, the init (=search/set modules) pushbutton can be activated. The bus is scanned for connected modules, and all modules are initialised with the values set at the front panel (or when "MEM" switch is activated the script is executed). The same function is triggered at power up.

MEM/PANEL switch:
Switching to **MEM** position starts executing a command script. The script can be programmed via USB or RS232 to the nonvolatile memory of the MSPI.
In **PANEL** position the front panel setting for threshold are used (and gain will be set to mid-position).

Diagnosis: Amp/Pos
For signal settings (gains and threshold), the output amplitude of the tubes must be analysed.
The Amp/Pos pushbutton toggles amplitude and position mode.
In amplitude mode the amplitude output of the tubes (left + right signal) is transmitted to the parallel interface, in position mode the calculated 10 bit position is transmitted. The MSTD-16 always transmits the amplitude.

Event buses, indicators
Status LEDs show activity and errors on the eventbus, one for each possible device address.

Remote control operation:

Remote control over the RS232 or the USB interface allows detailed settings for each individual channel (gains) or module (threshold), as well as for the integrated test pulser. To create a standard initialisation at power up, the commands can be written to a nonvolatile script memory (-> MEM/PANEL switch).

Interface settings:

RS232:
9600 Bd., 8N1 (eight data bits, no parity, one stop bit)

USB:
using the FTDI generic comport driver allows communication like over a serial com port. Up to date drivers for most common operating systems can be found at:
http://www.ftdichip.com/FTDriver.htm

Command set:

The following command set is used to control the parameters of the connected MPSD-8 or MSTD-16. Just enter the commands in a terminal window with a serial connection to the MSPI.

General:

device	module address
channel	channel number (where applicable) attention: channel numbers are zero based in rc and script operation. Channel 1 at the MPSD-8 frontpanel is addressed as channel 0 in rc.
value	numerical value (where applicable) are to be replaced with the intended numerical values.
<CR>	means the <carriage return> or <enter> key.

Successful commands are echoed like entered, failing commands are echoed with a leading "-" minus sign. Invalid commands produce an "error" message.

Commands:

Set gain:
the channel gain is defined by the numerical value of an 8 bit digital potentiometer (0…255 in arbitrary units). This corresponds to approximate values of [0.5…2.0] in gain, where 128 is "middle" position, 0 leads to half amplitude and 255 to double amplitude.

ga *device channel value* <CR>

sets the gain value for the specified channel in the specified module.
Example: "ga 3 4 135<cr>":
sets gain for module address 3, channel 4 to a numerical value of 135.

Set threshold:
the module gain is defined in percent of full range and can be directly entered in percentage values [0…100]

th *device value* <CR>

sets the threshold value for the specified module.
Example: "th 3 45<cr>":
sets the common threshold for all channels of module 3 to 45%.

Set pulser amplitude:
Pulser amplitude again is defined in arbitrary units [0…255] (the 8 bit potentimeter). 40 is a good start value when operating with gain 1.0 (= 128).

pa *device value* <CR>

sets the pulser amplitude for the given module address.
Example: "pa 0 40<cr>":
Set pulser amplitude for module 0 to 40.

Set pulser position:
Using remote control, the test pulser can be set to one channel of a module. Within this channel, it can be positioned left, middle or right to check position electronics.

pp *device channel pos*<CR>
with pos = [l, m, r] for left, middle, right.

sets the pulser position in the given module to the given position and channel.
Example: "pp 2 8 m<cr>":
Set pulser to middle of channel 8 in module 2.

Switch pulser on/off:
Pulser can be switched on and off, keeping previous settings for position and amplitude. Please be cautious to switch all pulsers off before taking "real" data! (using the pulser "on" and "off" knob at the front panels does this job reliably.)

`p0 device<CR>`

(with `0` being the number zero) switches the pulser in the given module off,

`p1 device<CR>`

switches the pulser in the given module on.
Example: "`p0 0<cr>`":
Switch pulser in module 0 off.

Switch acquisition mode:
MPSD-8 can be run in position or amplitude mode as described above.

`mp<CR>`

activates position mode,

`ma<CR>`

activates amplitude mode.

Script (Memory) operation:

MSPI has a flash memory to build and perfom scripts containing the above described commands.

Record script:
Scripts are built by just "recording" the commands entered in rc operation. To activate and end script recording, use the following commands:

`r1<CR>`

switches script recording on,

`r0<CR>`

switches script recording off. Every valid command that is entered between the `r1` and `r0` command is appended to the current script.

List script:
Printing a script in the terminal window is done by:

`li<CR>`

Delete script:
Clearing script memory is performed by:

`cl<CR>`

Perform script:
A prerecorded script is performed by entering

`ps<CR>`

Switching from "Panel" mode to "Memory" mode also performs an available script, and also a power up or pressing the "Init" button with mode selector in "Memory" position triggers script execution.

Quick start:

For a first look on the operation of MSPI together with one MPSD-8, proceed like follows:

- Connect MSPI and MPSD-8 with the event bus BNC cable (RG58). Be sure to use a 50 Ohms termination at the MPSD-8 side
- Press "Init" at the MSPI, the LED corresponding to the MPSD-8 device address should light.
- Set threshold knob to 20%.
- Press "Pulser" at the MSPI – Eventbus LEDs should now show activity at MSPI and MPSD-8. Data are output at the SubD-25 parallel port (as well as at the "data" and "address" dignaostic ports, which are ideal for a quick oscilloscope check).

Detailed setup:

A more detailed electronics setup of a 3He psd detector system can be performed with the following steps:

- Change MSPI to amplitude mode (either with frontpanel pushbutton or with rc command `"ma"`
- Ramp detector bias voltage to the estimated value.
- Check the resulting amplitude spectrum and adjust bias voltage. The thermal peak position of the amplitude spectrum should be shifted to about 80% of maximum range.
- Set threshold accordingly to cut off the gamma tail in the lower part of the spectrum.
- If necessary, adjust individual channel gains using the rc command `"ga"`
  `ga device channel value`

Data output format:

MSPI presents the following signals at its parallel data interface:

- 4 bit module address
- 4 bit channel address (for MPSD-8: C3=position/amplitude mode)
- 10 bit conversion data (amplitude/position)
- strobe for data ready (active low)

Parallel interface:

- Eight bit address (higher nibble: module, lower nibble: channel)
- 10 bit conversion data

Name	A7	A6	A5	A4	A3	A2	A1	A0
Comment	M3	M2	M1	M0	C3	C2	C1	C0
MSPI pin	20	19	6	18	5	17	4	16

Name	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Comment	P/A 9	P/A 8	P/A 7	P/A 6	P/A 5	P/A 4	P/A 3	P/A 2	P/A 1	P/A 0
MSPI pin	24	11	23	10	22	9	21	8	25	12

Name	L (strobe)	gnd	gnd	gnd	gnd
Comment	100 ns pulse				
MSPI pin	2	1	7	13	

Data transfer rate:

Mean transfer rate 640 kHz at 20 % deadtime, 3 MHz maximum rate (all 4 buses used).
For higher rates the system can be parallelized.

Technical data:

Size:
1/12 NIM form factor
227 x 221 x 34 mm

Weight:
850 g

Power:
Voltages:
+6V, 200mA
-6V, 10mA
Power dissipation:
1.1W