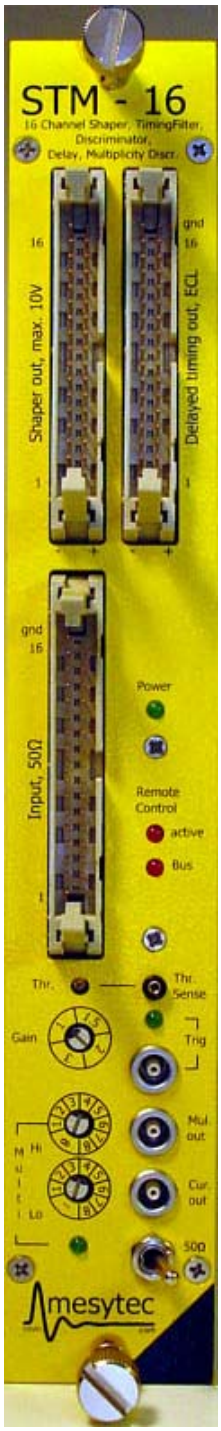
STM-16

16 fold shaper with timing and multiplicity trigger

The mesytec STM-16 is a shaping / timing filter amplifier with discriminator and multiplicity trigger specially designed for single or double sided multistrip silicon detectors. It can best be used in conjunction with the preamps of the mesytec MPR-Series.

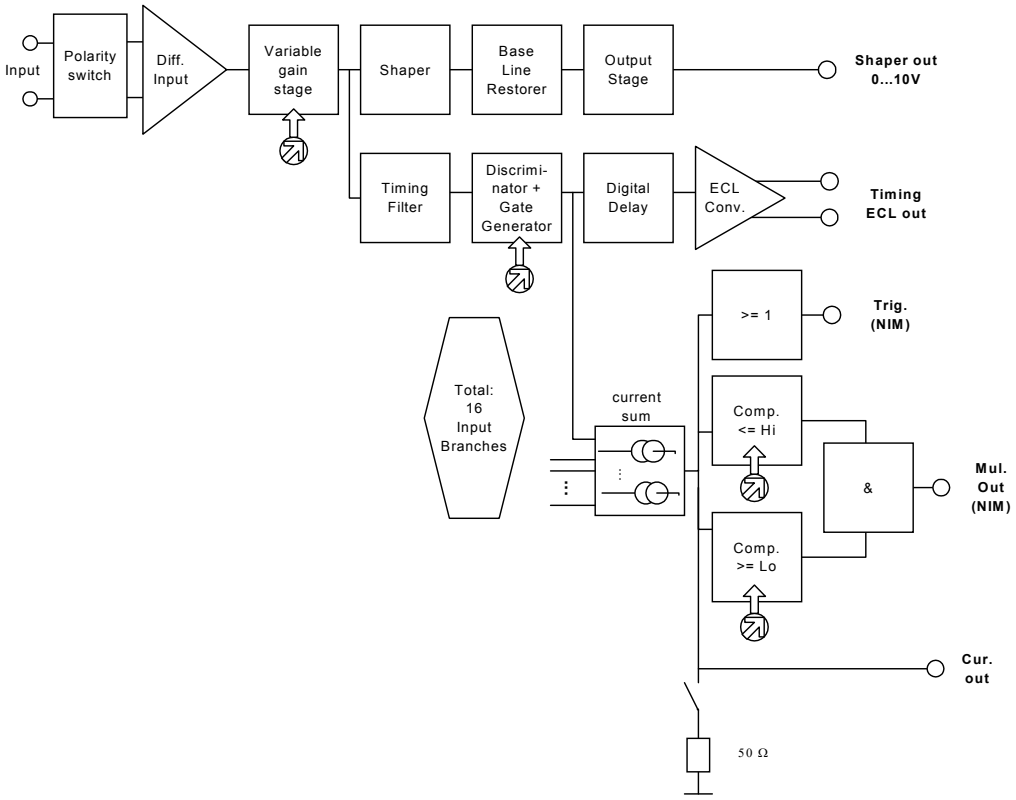


Features:

- 16 channel NIM module
- Shaper amplifier with baseline restorer
- Timing filter amplifier
- Leading edge discriminator
- Digital delay of 400ns for timing stop
- ECL timing output
- Trigger output
- Multiplicity trigger

Option: Remote control of discriminator thresholds and gains

Schematics:



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Technical Data:

Input stage

- Input connector: 34 pin male connector
- Input resistance: terminated with 50Ω, adapted to twisted pair cables.
- Input signals: differential, typ ±1V for maximum amplitude at gain 1.
- Polarity can be changed with a 4∗16 pole connector (inside the case)
- Gain adjust: gain can be set to 1, 1.5, 2, 3.
- Sensitivity can be changed by an additional factor 5 at the MPR preamplifiers .

Shaper:

- Output amplitude: 0 to 10V
- Baseline shift at 100kHz and 5V output: VBL100 < 1% (1µs shaping time)
- DC-Offset: VDC +0V to 0.2V
- Pulse shape: 50% width T50% = 0.9µs (1us shaping time)
- Pulse shape: 1% width T1% = 2µs (1µs shaping time)
- Peaking time (preamp input signal to shaper pulse maximum) ΔT = 0.8µs
- Output connector: 34 pin male connector
- Standard shaping time: 1µs

Timing filter amplifier:

- RC-CR, 10ns / 75ns

Discriminator:

- Leading edge
- Threshold: adjustable, 0 to 4V (= 0% to 40% maximum range)
- ***The switch on the front panel must be on "50Ω"***

Gate generator, Timing delay, ECL output
(->see also ECL application note)

- Pulse width for trigger output: 400ns
- Timing stop- ECL-Signals:
  delay 400ns from trigger,
  width 200ns
- Output connector: 34 pin male connector
- Typical timing resolution for 5 MeV signals from silicon detector (10 * 10 mm^2, 500 µm, 60V bias): dT = 400 ps. (For strong variation of the signal amplitude, a walk correction is necessary.)
- Improved timing with MPR-16-fast type of preamplifier and fast rise time detectors.

Multiplicity trigger:

- Each channel above threshold contributes to multiplicity level, a multiplicity trigger is generated for: lower multiplicity threshold ≤ multiplicity level ≤ upper multiplicity threshold
- coincidence interval: (30 ns up to) 70 ns
- The multiplicity trigger is 70 ns delayed to the trigger signal.
- Lower multiplicity threshold: 1 … 8, upper multiplicity threshold: 1 … 8 and ∞
- Multiplicity chaining: multiplicity outputs from several modules can be connected, resulting in a total multiplicity level of all connected modules. Multiplicity trigger windows of the connected modules act independently on the total multiplicity.
- ***The switch on the front panel must be on "50Ω" if modules are not chained.***
  If modules are chained, one "50Ω" switch has to be on the others have to be off !

Power consumption: (max 6W)

- +6V 350 mA
- -6V –450 mA
- +12V 50 mA

Remote control

The modules are prepared for the remote control of individual thresholds and gains. The remote control unit is a plug in module which can also be inserted as an upgrade.

Typical ranges:

Use with preamplifiers **mesytec MPR-16, MPR-32, MPR-64**. Typical ADC-range 0.25V to 10V

- Preamplifier type “100 MeV”: energy deposition from 0.2 MeV to 100 MeV can be measured
- Preamplifier type “ 25 MeV” : energy deposition from 37 keV to 25 MeV can be measured

Digitisation:

Well suited multichannel ADCs and TDCs:

CAMAC:	Phillips Scientific (16 channels), Silena (8 channels)
VME:	CAEN (32 channels)

Example:

- Readout of a 16∗16 two sided Si-strip-detector, 500 um thick, 60V bias voltage
- Energy deposition of particles 1.5MeV to 15MeV
- Measured parameters: timing, energy deposition, and position of two simultaneously implanted particles.

The amplitudes on both sides are needed to correlate the four measured x1, x2 and y1 and y2 positions. The two x/y positions with the same amplitude belong to the same particle. Timing is needed to measure the time of flight with a start detector (timing of one side is good enough) or the time difference of the two particles.

The multiplicity trigger is used as as a data acquisition trigger and TDC start. The multiplicity current outputs of both modules are connected and the lower and upper threshold adjusted to 4. Only one 50Ω switch on one STM front panel should be switched to "50Ω on" !
This selective trigger suppresses single hits and reduces background rates efficiently.

List of electronics:

Preamplifier:	1 ∗ mesytec MPR-32 type "100MeV"
Shapers:	2 ∗ mesytec STM-16, 1μs shaping time
ADC:	2 ∗ Phillips Scientific "7164H"
TDC:	1 ∗ Phillips Scientific "7186H", 800ns range.

ECL-application note

A) STM-16 powered * new feature ***
Some target devices only terminate a twisted pair line with 110Ohm without delivering the negative supply (CAEN 775, Phillips modules) . For those devices the sender has to deliver the negative voltage. Now a new connector PCB (replacement for the actual ECL output PCB) is available which provides the supply. It includes a jumper to disconnect the biasing. It is included as standard for all devices from 6/2003.

B) Target device powered
There exist two different types of ECL-logic, called 10k -ECL and 100k -ECL logic. They are both used in nuclear physics electronics. Due to their different maximum signal levels they are not completely compatible. The problem is not the different logic thresholds, but the maximum allowed range of input voltage. If the signals go beyond those limits, the circuit goes into saturation and gets insensitive to fast input signals.
For 10k logic the signal must be higher than -1.95V and lower than -0.80V. For 100k logic the signals must be within the range of -1.81 and -0.88V. The STM-16 uses serial resistors of 3.9Ω in the ECL lines which makes voltage drop of 80mV for the high signal and shifts the amplitude to a level which is compatible to both logic types.
For practical use the voltage drop for the ground return line with a current of 400mA, (which is only two wires of twisted pair at the 34 pin connector) , can get critical. For 1m of cable, the ground wire voltage drop is about 50mV.
To get good ECL-connections between modules in different bins, **connect the ground of the bins very well**. The ground connection then will carry the ECL ground current. With a good ground connection the ECL cables from STM to an ADC or TDC may be 10m for 100k logic and 30m for 10k logic. With no ground connections they may be only 1m and 2m.

Remote Control

The STM-16 be equipped with a remote control option.
The NIM-controller module MRC-1 is necessary as a bus master.

The **discriminator thresholds** can be individually adjusted from
0..40% of the maximum range in 256 steps.

The **gain** can also be adjusted individually in 4 steps:
setting 0 =gain 1,
setting 1 = gain1.5,
setting 2 = gain 2,
setting 3 = gain 3

The parameters are organised in a 32 word memory array. The gain parameters are situated at the even position 0...30 (channel 1 .. channel 16) , the thresholds are situated at the odd positions 1...31 (channel 1..16)
The commands are transmitted via event bus, which can be connected to the rear side of the STM-16 module. The ID-number which is set with the coder identifies the module in the bus chain and must be unique for one bus line.

Rear side of STM-16:

Coder for 16 bus addresses (0..F)

Bidirectional event bus

Power supply output for preamp MPR-16

Memory List STM-16:

ADR	GAIN/THR	ADR	GAIN/THR
0	gain 1	16	gain 9
1	threshold 1	17	threshold 9
2	gain 2	18	gain 10
3	threshold 2	19	threshold 10
4	gain 3	20	gain 11
5	threshold 3	21	threshold 11
6	gain 4	22	gain 12
7	threshold 4	23	threshold 12
8	gain 5	24	gain 13
9	threshold 5	25	threshold 13
10	gain 6	26	gain 14
11	threshold 6	27	threshold 14
12	gain 7	28	gain 15
13	threshold 7	29	threshold 15
14	gain 8	30	gain 16
15	threshold 8	31	threshold 16

The memory positions can be written with SE command and can be read with RE command.
A mirror page is available. It can be written with SM and read with RM and copied with CP.

The commands RST sets all thresholds to the value 32 and all gains to the value gain = 2.

The ON/OFF command makes the remote control active or inactive. The power up default is inactive. While inactive the manual values from the front panel elements are set.

Identification code for STM (detected when running the scan bus command "SC") is IDC = 16

Example:

reset all channels of STM-16 module ID 7 on bus 0 to defined values:
RST 0 7

to set the channel 3 of module with ID 7 on bus 0 to gain = 1.5 and the threshold to 20% type:
SE 0 7 4 2 //set gain of channel 3 = address 4
SE 0 7 5 128 // set threshold of channel 3 = address 5

activate remote control
ON 0 7

Command Summary:

data formats:

bus = bus number [0...1]
dev = device number [0…15]
adr = parameter number [0…31]
gain = [0…3]; gain 1 = 0, gain 1.5 = 1, gain 2 = 2, gain 3 = 3;
thr = [0…255]; 0..255 corresponds to threshold 0..40% maxrange

Mnemonic	Description
SC *bus*	STM 16 allows scan bus, returns id code: IDC=16
ON bus dev	activate RC
OFF bus dev	deactivate RC
SE *bus dev adr gain/thr*	set gain(even address) or threshold (odd address)
RE *bus dev adr*	read gain or threshold value
RST *bus dev*	reset gain and threshold to default values
SM *bus dev adr gain/thr*	set mirror parameter (even address = gain, odd address = threshold)
RM *bus dev adr*	read mirror cell
CP	copy mirror to active memory

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