C-TS 105

8CH TDC Module
(Long Range Ultra Resolution & Multi Hit)

HARDWARE MANUAL

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1 Specification

・Number of channel	:8CH
・Measurable time	:0～10 μS
・Maximum resolution	:10pS /CH
・Input signal	:FAST NIM
・Start input	:Common
・Clear input	:Common
・Input impedance	:50Ω
・Measured value	:23bit (real number)
・Operation time	:About 1.5 μS
・Linearity	:±70pS
・Package	:CAMAC 1-span

2 Product Description

C-TS 105 is TDC of 8-channels. The measurement data of TDC is 23 bits. And it is 10 μ seconds in measurement time.

When a Start-signal is input, the stop input is enabled, and the channel which the Stop-signals were input into starts the measurement.

At the conversion time of each channel, it is range of measurement + about 1.5 μ second.

The user cancels the measurement by Clear-signal and CAMAC function (F9) and can initialize a module.

For measurement time, you can set it in F (16) A (0). In addition, it occurs when LAM passes between these times. F (8) can test LAM. In addition, LAM is output when LAM-ENABLE to a CAMAC-data bus.

You can measure the multi-hit function of this module until up to 32 hits. The time for this case resolution is 27p seconds. The user can read the channel which made a hit by F (1) A (0).

3 CAMAC FANCTIONS

N･F(0)A(0-7)	:Data read of CH0～CH7
N･F(1)A(0)	:Data read of HIT CH
N･F(2)A(0-7)	:Data read of HIT Number (CH0～CH7)
N･F(8)A(0)	:TEST LAM
N･F(9)A(0)	:Initialize
N･F(16)A(0)	:Setting of the maximum measuring time
N･F(17)A(0)	:0-15BIT Register Load
N･F(17)A(1)	:15-23BIT Register Load
N･F(18)A(0-15)	:24-31BIT Register Load & Write Address＝A(0～15)
N･F(24)A(0)	:DISABLE LAM
N･F(25)A(0)	:Measurement enable (START,STOP inputs)
N･F(25)A(1)	:Initialize of TDC
N･F(26)A(0)	:ENABLE LAM

4 Signals

4.1 START INPUT

Number of channels	: 1 (Common)
Signal	: FAST NIM
Input Impedance	: 50Ω
Minimum Width	: 5nS
Connector	: LEMO-TYPE (00.250)

4.2 STOP INPUT

Number of channels	: 8
Signal	: FAST NIM
Input Impedance	: 50Ω
Minimum Width	: 5nS
Connector	: LEMO-TYPE (00.250)

4.3 CLEAR INPUT

Number of channels	: 1 (Common)
Signal	: FAST NIM
Input Impedance	: 50Ω
Minimum Width	: 100nS
Connector	: LEMO-TYPE (00.250)

5 Set Up

C-TS 105 has to set various registers for internal TDC circuit.
The user initializes the register in the following procedures.

The following example:
Resolution····27pS/1bit
Multi-hit·····Max 32
WDATA·····Hexadecimal indication

FUNCTION	SUB ADDRESS	WDATA (Hex)
F17	A0	AB
F17	A1	0
F18	A0	
F17	A0	620
F17	A1	62
F18	A1	
F17	A0	2004
F17	A1	6
F18	A2	
F17	A0	0
F17	A1	0
F18	A3	
F17	A0	0
F17	A1	200
F18	A4	
F17	A0	0
F17	A1	0
F18	A5	
F17	A0	0
F17	A1	800
F18	A6	
F17	A0	1FB4
F17	A1	0
F18	A7	
F17	A0	0
F17	A1	7FF
F18	A11	

F17	A0	0
F17	A1	0
F18	A12	
F17	A0	0
F17	A1	0
F18	A14	
F17	A0	1
F17	A1	240
F18	A4	
F9	0	

The range of measurement (Full Scale) is settable by an F (16) A (0) until 10 μ seconds by 1 μ second.

FUNCTION	SUB ADDRESS	W1	W2	W3	W4	FULL SCALE(μ s)
F16	A0	1	0	0	0	1
		0	1	0	0	2
		1	1	0	0	3
		0	0	1	0	4
		1	0	1	0	5
		0	1	1	0	6
		1	1	1	0	7
		0	0	0	1	8
		1	0	0	1	9
		0	1	0	1	10

Note:

・Even if this TDC changes a full scale, the time resolution does not change.

・The user must set the full scale. Otherwise this module does not work.

6 Procedure of the measurement and the reading

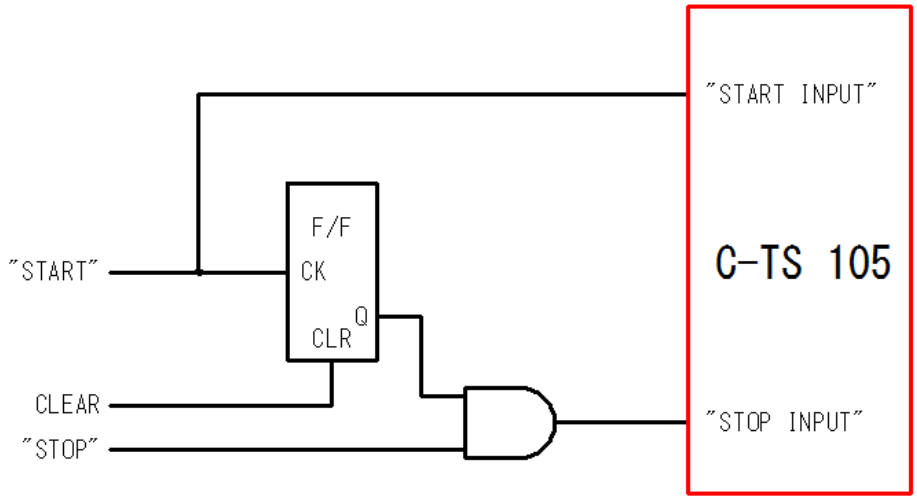
(1) The user must execute F (9) a (0) after setup.

(2) You execute F(25)A(0) and enable input.

Note :

When F(25)A(0) is execute as for this module, “STOP” is counted. When “STOP” signal inputs as for this even if there is not input “START”, the multi-hit counter works. You must avoid this decrease.

For example, “STOP” signal becomes effective after an “START” signal with an another circuit.



(3) When an “START” signal is input, this module starts the measurement.

(4) The “STOP” signals are sent to the TDC circuit of the input channel and starts conversion. The conversion is finished after approximately 1.5 μ second from the time for set full scale. And this module outputs a conversion end flag. TDC finishes a calculation at this point in time and can read conversion data from a register. The STOP signal input during full scale time is measured to up to 32 and it is written in at internal memory.

The hit channel is read in F(1)A(0).

The number of the hits of each channels are read in F(2)A(0～7) .

(5) LAM occurs then. LAM TEST is execute out in F(8).

(6) The Hit number data are read out by F(2)A(0～7).And the time data (23BIT data) are read out by F(0)A(0～7). The time data reading repeats the number of hits.

(7) The data information is cleared when you read all data.

(8) The “START” signal input is enabled when you execute F(9). However, this module cannot measure you until I execute F(25)A(0).

7 Calculation of data

It is necessary for you to convert the data which you read in F(0)A(0～7) in the following calculating formula for real time.

WDATA is 24bit data of CAMAC.

Actual Time = WDATA × 27.4348 ÷ 1000 (nS)

8 Appearance condition of LAM

When an START signal is input, and full scale time passes, LAM appears.
Of course this is after a module is in a measurable condition.
You can check LAM in F (8) A (0). [TEST LAM FUNCTION]

9 Front Panel