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TECHNICAL NOTICE SMTU

SMTU MODULE

NTTU-0324

TECHNICAL NOTICE

PROGRAMMABLE TIME

DELAY RELAYS

SMTU

NTTU-324
Rev. 0

<u>Programmable time delay relays SMTU</u>

General information

AUTHOR :   Robert Desvigne   92-08-04
VERIFIED :   96-12-19
APPROVED :   97-1-10

Revision history

DATE	REV.	DESCRIPTION	AUTHOR	VERIFIED	APP.
96-12-19	0	**First release**	R.D.		

APPLICATION

The SMTU is a universal timer which provides a time shifted signal with respect to an input signal.

It complies with all requirements for ANSI devices 2 and 62 for a wide range of time delays. It can be used within protection or control schemes with protection and/or auxiliary relays.

It is especially suited for applications where limited space, high accuracy or settings which include output relay operate times are required.

MAIN FEATURES AND ADVANTAGES

Compact design, up to 4 separtate timers in a single module.

Can be packaged with other functions in an industry standard 19 inch rack, Versa®.

Low cost solution compared to conventional electro-mechanical auxiliary time delay relays.

Micro-controler technology design.

Protected against input signal polarity inversions.

Front panel setting devices and annunciators.

Extremely wide time setting range, from 0.001 to 99000 seconds (27.5 hours).

Reduced requirements for spares inventory; one model satisfies all applications.

Each stage can be field set as a time delay on pick-up or drop-out relay.

Output contactor configurations are user defined and field set.

High timing precision.

Low consumption.

State-of-the-art immunity to external disturbances.

**Field proven** auxiliary relays (output contactors) are used.

Integrated self-checking feature for optimum dependability and remote signalling.

Compatible with complete family of protection and control relays available for complete substation/plant protection.

Direct replacement to prior generation SMTS time delay relays.

Keyed pin interlock prevents insertion in wrong location.

Factory testing confirms design and component performance prior to site commissioning.
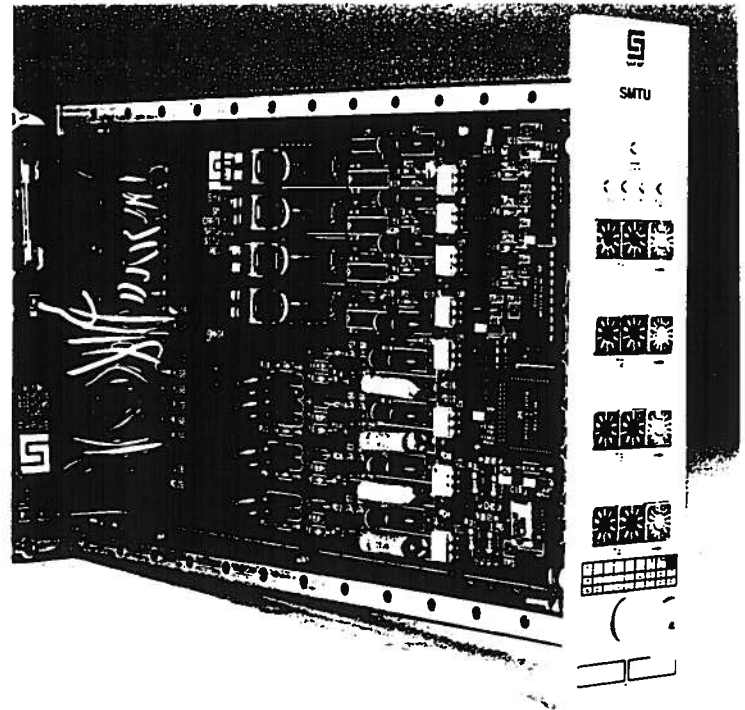
ELECTRICAL DESIGN

There are three main functional blocks: the supply, the central processing unit (CPU) and the user interface (front panel).

SUPPLY

It is composed of an input filter section, a switching power supply and a supervision circuit ("watchdog").

The filter protects against incoming transient over voltages and polarity inversion. The switching power supply reduces the 129 Vdc input to an isolated 5 Vdc, to power the electronic dc circuits on the CPU card.

The supervision circuit will inhibit operation if either:

- the input voltage has not attained the minimum preset operating level,
- the micro-controller stays in the reset mode,
- the 5 Vdc voltage is not available.

CENTRAL PROCESSING UNIT (CPU) CARD

This card is composed of::

- 4 opto-coupler isolated and filtered digital input circuits;
- a CPU (Motorola 68HC811 micro-controller) which manages the inputs, outputs and user interface via its five 8 bit ports, its 256 bytes of RAM (settings) and its 2 kbytes of EEPROM where resides the application software;

- a programmable counter to supply a 1 ms time-base to the micro-controller for accurate timing;
- a reset circuit which assures that upon power-up the unit remains stable and does not produce a spurious output;
- micro-controller-activated relay outputs.

USER INTERFACE (FRONT PANEL)

The interface is composed of setting and indication devices.

The setting devices consist of two types of BCD mini-selectors, eight of which are 10 positions, and four of which are 16 positions.

The indication devices consist of one orange LED for supply status and four orange LED'S for timers T1, T2, T3, T4 status:

- quiescent (extinct),
- timing in process (flashing),
- output operative (orange signal maintained).

CONTROLLER DESIGN

The controller operates at 1 MHz frequency. Its five 8 bit input/output ports are used as follows:

- one for input readings and output write-ins,
- two for setting device management,
- one for timer status indication,
- one to select the operation mode (calibration or normal operation).

It affords 256 bytes of RAM for the stacks and settings and 2 Kbytes of EEPROM for the application software. The software is divided between calibration and normal operation.

Calibration must be performed prior to normal operation. It is performed by a simple feedback comparison of output and input signals; it detects the closing of the output contact, resulting from a digital input, and calculates the operating time of the associated output relay. In order to obtain the most reliable and realistic value, an average of ten measurements is taken and its value stored in the EEPROM.

During normal operation, the software is functionally divided into two parts:
- the first to manage setting parameters;
- the second, based on signal interrupts, reads the digital inputs, manages the targets and the timer count-down when they are in operation and finally activates the output relays.

Compensation is carried out for the auxiliary relay response time measured during calibration and is subtracted from the selected front panel time setting. Thus timing values as close as possible to the one selected are assured.

The programmable counter (Motorola 4568) divides the 1 MHz micro-controller output by a factor of 1000, thus affording the 1 ms time-base.

The reset circuit (MAXIM MAX 690) supervises the micro-controller during power-up by maintaining a logic "O" level for a further 50 ms after the auxiliary supply exceeds 4.65 V dc and then switches to logic "1". The time lapse is sufficient for the micro-controller to detect the RESET signal and proceed with initialization.

AVAILABLE OPTIONS AND SELECTIONS

The universal nature of the product yields that no specification is required at time of order other than the auxiliary supply voltage and the type of output contactor desired.

The options and selections which are user chosen and field applied include timing mode, time delay and output relay configuration.

Shorting links within the module allow field configuration of input/output circuit relationships (see below):
- a maximum of eight form C output contacts are available for a single input circuit;
- output contact configurations are user selected, either 5 A rated, form C or 0.5 A rated N/O reed contacts.

CIRCUIT RELATIONSHIPS
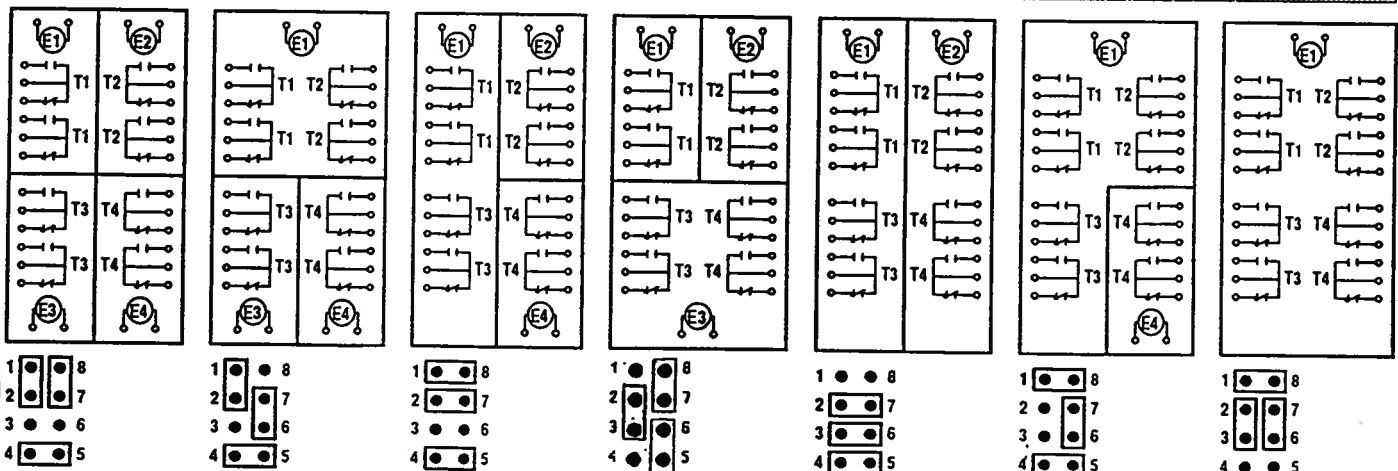
CONTROL

Voltage	Nominal	129 V dc	
	Minimum operating	105 V dc	
	Maximum in steady state	75 V dc	
Thermal capability	Maximum acceptable voltage	Permanent	141 V dc
		For 30 s	150 V dc
Impedance	At nominal voltage	< 14 000 Ω	
	At maximum permanent voltage	< 12 500 Ω	
Operating time	Minimum impulse	1 ms	

AUXILIARY

Auxiliary voltage	Nominal	129 V dc	
	Minimum operating	105 V dc	
Thermal capability	Maximum acceptable voltage	Permanent	141 V dc
		For 30 s	150 V dc
		For 2 s	160 V dc
Consumption	Operating	≤ 4.5 W	
	Maximum	≤ 8 W	

DC OUTPUTS

Number / type	8 INV per function			
Rating	Permanent	5 A dc	Making (resistive circuit)	5 A dc
	Transient (50 ms)	250 A dc	Breaking - resistive	0.3 A dc
	For 2 s	30 A dc	Breaking - inductive	0.15 A dc
	For 30 s	7.5 A dc		
Voltage	Maximum acceptable, permanent	250 V ac		
Defined time delay	Operating time	± 4 ms for T < 2 s		
		± 0.2 % for T > 2 s		

TARGETS

Number and type	Five front-panel mounted LED targets, activated by software	
Colour	Orange	
Functions / events	1 top LED	Supply status
	4 bottom LED's	Timers T1, T2, T3, T4 status

EXTERNAL

Temperature	Storage between -25 °C and 70 °C	Operation between + 5 °C and 40 °C
Humidity	Storage and operation under 95 %	
Impulse voltage withstand	2500 V peak	
Transient immunity	SWC	2500 V peak
	RFI	15 W at 49 MHz, 5 W at 142 MHz or 464 MHz
Dielectric withstand	ANSI C 37.90, 1500 V ac, RMS, 60Hz, 1min	

MECHANICAL

|		WIDTH	HEIGHT	DEPTH
Dimensions				
	Module 1 seat	41,5 mm (1.65")	177 mm (7.0")	283 mm (11.13")
Maximum weight	Module	1 kg (2.2 lbs)		
Exterior finish	Front panel	Aluminium 1100-H14AQ		
		Epoxy silk screen-printing, thermoplastic ink.		
Number of terminals	Voltage	37		
	Current	None		
	Short-circuiting	None		

MECHANICAL DESIGN

The SMTU is a 1-seat-width, front mounted, withdrawable module. It can be housed in a 2-4-6-8 or 10 seat industry standard 19" rack, type Versa®.

The layout of the module consists of one full size (CPU) and one half size (supply) PCB as well as a back to back front plate-mounted PCB for BCD Mini-Selector Time-Dial connections. Setting information is silkscreened on the front panel. The front plate contains one LED for supply status indication, and four LED's for Timers T1-T4 status.

The rear module Terminal assembly consists of three parts: two with terminals, and one for the mechanical interlocks.

SETTINGS

SW1   SW2   SW3
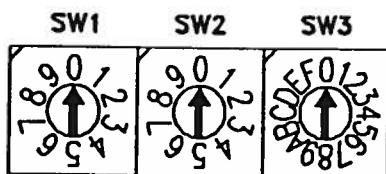
The rotary selector SW3 is used to select the timing mode pick-up (↗) or fall-back (↘) as well as the desired range, i.e. 1 ms, 10 ms, 100 ms, 1 s, 10 s, 100 s or 1000 s.

The rotary selectors SW1 and SW2 set the multiplication factors. The combination of the three chosen SW* settings constitute a complete timer setting. When more than one configuration is possible, the selection is based on the required step increment.

The SW3 setting is chosen from the table below, silk-screened on the module front panel.

T	1 mS	10 mS	100 mS	1 s	10 s	100 s	1000 s	
↗	0	1	2	3	4	5	6	7
↘	8	9	A	B	C	D	E	F

TEST

An integrated self-checking feature supervises both the auxiliary supply and controller software status. A drop below 94 Vdc or a failure of the controller to reset within 33 ms (software initiated) will lead to a controlled shutdown of the controller and a remote signalling contact will close.

Field testing should monitor timer accuracy against an accurate timing reference as well as input/output configuration.

RELATED DOCUMENTS

For more detailed information on related equipment, please refer to the following documents.

PRODUCT	FUNCTION	REF #
SMTU	Programmable time delay relay	NTTU-107
SMTS	Static time delay relay	FCTS-102
VERSA®	Modular rack system	FCAP-146
TROPITEST	Secondary injection test assembly	FCTR-161
SMRA-H-S-X	All-or-Nothing auxiliary relays	FCRE-122
SMDS	Solid-state trip device	FCDS-104

ORDERING CODE

Quantity of SMTU [   ]   FORM C Contacts [   ]   REED Contacts [   ]
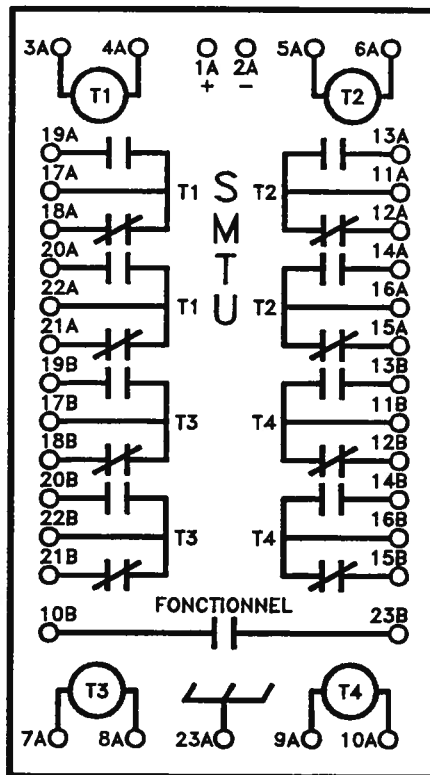
Snemo Ltd

Suppliers of:
- protection and control relays and systems
- utility apparatus monitoring and control products
- protection application and coordination studies
- relay and circuit breaker test instruments

3605 Isabelle Street, Brossard (Québec), Canada, J4Y 2R2
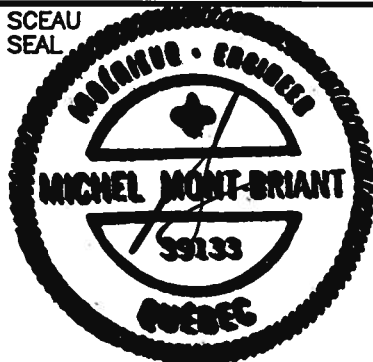Tel.: (514) 444-3001   Fax: (514) 444-3009

SMTU

FONCTIONNEL

Terminals: 3A, 4A, 1A +, 2A -, 5A, 6A, T1, T2
19A, 17A, 18A, 20A, 22A, 21A, 19B, 17B, 18B, 20B, 22B, 21B
13A, 11A, 12A, 14A, 16A, 15A, 13B, 11B, 12B, 14B, 16B, 15B
T1, T2, T3, T4
10B, 23B
T3, T4
7A, 8A, 23A, 9A, 10A

	REVISIONS		IND.	DATE (AMJ/YMD)	NOM/NAME

SCEAU SEAL				
DATE: AMJ/YMD	88-12-06		**S** Snemo Ltee/Ltd	
DESSINE DRAWN	Y.M.			
PROJETE PROJECTED	R.G.		**MODULE SMTU**	
VERIFIE CHECKED			**PLAN DE BORNAGE**	
APPROUVE APPROVED				

MICHEL MONT-BRIANT
39133

| FORMAT: A4 | ECHELLE: SCALE: N/A | FEUILLE SHEET | 1 DE OF 1 | P,B,T,U | 1,0,6 | 0 |