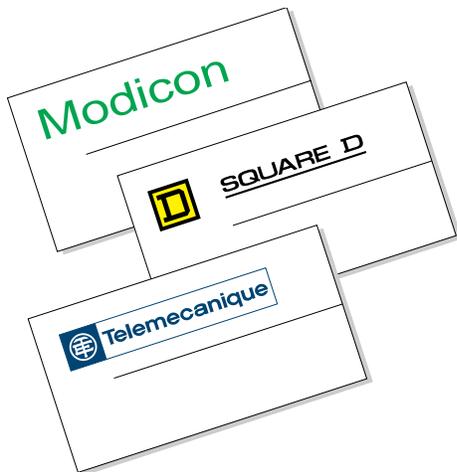


# Modicon TSX Nano PLC

## The Big Solution in a Small Package



**GROUPE SCHNEIDER**

■ Modicon ■ Square D ■ Telemecanique

# Compact to Fit Most Any Application

## Extremely Compact, to Fit a Wide Range of Applications

The Modicon TSX Nano responds to the ever increasing demand for greater flexibility and customization of automation and control equipment. Extremely compact, it is a cost effective replacement for traditional solutions. Its small size makes it flexible in terms of installation cost, space, and simplicity.

Further, its features make it suitable to meet requirements ranging from the simplest applications to high-speed and sophisticated uses, in all types of applications.

## Powerful, to Answer the Toughest Needs

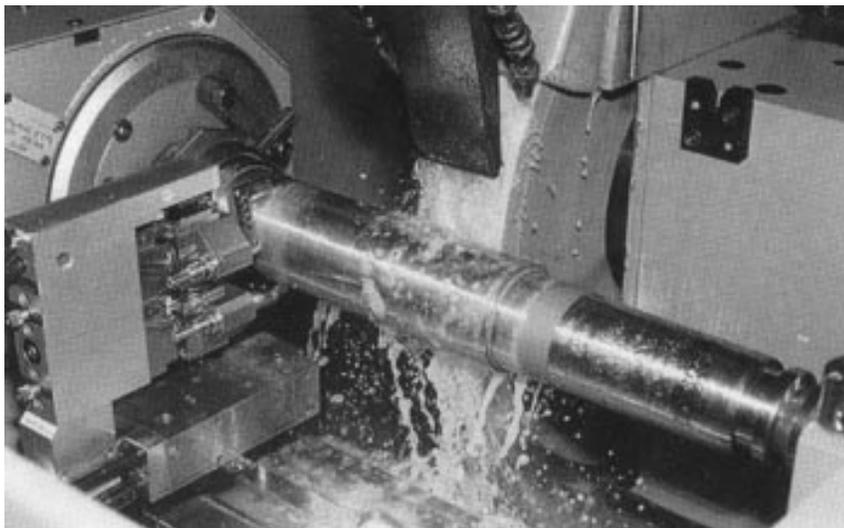
With its fast scan time and fast up/down counting functions, the TSX Nano optimizes machine response times and precision. Simply by setting parameters that use the integral real-time clock, the TSX Nano controls operations with reference to day or time, and date-stamps events. Operator interfaces can be directly connected via the TSX Nano terminal port, without the need for special equipment.

Up to four Nanos can be linked together for distributed applications, with an additional TSX Nano acting as an I/O extension, for a total of five TSX Nanos.

## User-Friendly, Simple Programming and Installation

Ready to use with standard applications, the TSX Nano can also be easily adapted to suit the special needs of any application. It is easy to program in the Instruction List or Ladder language. User-friendly tools include a pocket programming terminal and PC programming software, which speeds installation and development.

The Modicon TSX Nano PLC is easy to mount on a DIN rail or mounting plate, either vertically or horizontally, or even directly on the framework of the machine.



## Economic Cuts Unnecessary Costs

Available in three sizes, the TSX Nano PLC provides an optimal solution for applications with 10 to 48 I/O. Functions and features such as EEPROM memory, battery, real-time clock, high speed counters and pulse outputs, are built into the TSX Nano which contribute to stock optimizations that reduce costs. The outstanding quality/performance ratio of the TSX Nano increases the competitiveness of both your machines and equipment.

The extremely compact size of the TSX Nano PLC means that it is as easy to install in small enclosures as it is directly within the framework of machines.

Because it incorporates the power supply, inputs, memory and display in a single unit the TSX Nano simultaneously saves valuable panel space even further, and increases the size of applications open to the TSX Nano range.



*The Modicon TSX Nano fits all types of machines and applications.*

## The TSX Nano PLC Fits All Types of Machines and Applications

- Parking lot barriers, automatic doors for controlled access
- Pump management in water distribution
- Air conditioning for buildings in service industries
- Embroidery machines in the textile industries
- Quality control in manufacturing industries
- Wrapping and packaging in the food industry
- Industrial washing machines, vending machines, car wash facilities, and service machines
- Control of doors and lighting in public transportation vehicles



*The Modicon TSX nano delivers optimal performance for applications with 10 to 48 I/O.*

# Simple Programming and Installation is User-friendly

## A Flexible and Varied Range

The TSX Nano easily adapts to a wide variety of applications:

- 24V DC or 100-240V AC supply
- 24V DC or 115V AC Inputs
- 0.5 A transistor (sink or source) or 2.0 A relay outputs

Since its I/O are compatible with such control system components as two or three-wire proximity sensors, photoelectric cells, or conductors, no interface is needed and setup is simplified.

The integrated potentiometers on the front panel make it easy to debug and adjust applications.

## User Friendly Programming Tools

The FTX 117 terminal is just as easy to use in the design phase in off-line mode as on the shop floor when connected to the PLC. Its large back-lit four-line screen, contextual data entry using a limited number of keys, and "fill-in-the-blank" programming make it particularly user-friendly. An application or its data can be backed up either in the internal flash memory or onto the memory card (credit card format) which can then be transported and duplicated.



*The FTX 117 provides portable "fill-in-the-blank" programming.*



*The Modicon TSX Nano has all the features you would expect in a large PLC programming package, as well as the simplicity needed to get an application up and running fast.*

## PL7-07 Software A State-of-the-Art User Interface

PL7-07 PC Programming Software is a complete graphical environment for maintaining applications for the TSX Nano PLC. PL7-07 provides the essential and easy to use software tools necessary for today's programming needs and tomorrow's advancements.

The user interface is a Windows style development tool that you use to develop applications on IBM AT compatible PCs. Although PL7-07 has many of the attributes of a Windows program, it is actually run from DOS V3.3 or higher. PL7-07 brings a new standard to DOS PLC programming software by combining all the familiarity of dialog boxes and multiple windows with reduced PC system requirements. In addition, PL7-07 has all the features you would expect of a large PLC programming package and more.

## Easy Conversion of Ladder Diagrams

One of the many features of the PL7-07 is its ability to reverse Ladder diagrams to the List Language and back again. The design engineer may prefer the List Language, but deliver the application to the maintenance engineer in ladder, or, program in Ladder and export to countries where List is the preferred control language.



## A PLC Designed for High Speed Applications

The TSX Nano is designed for processing applications where response time is critical:

- Scan time is 3 ms per 1000 instructions.
- 10 kHz fast counter
- User-programmable input filter time, 100  $\mu$ s minimum
- Latching inputs, 50  $\mu$ s minimum
- Timers with 1ms time base
- 4.9 kHz pulse outputs

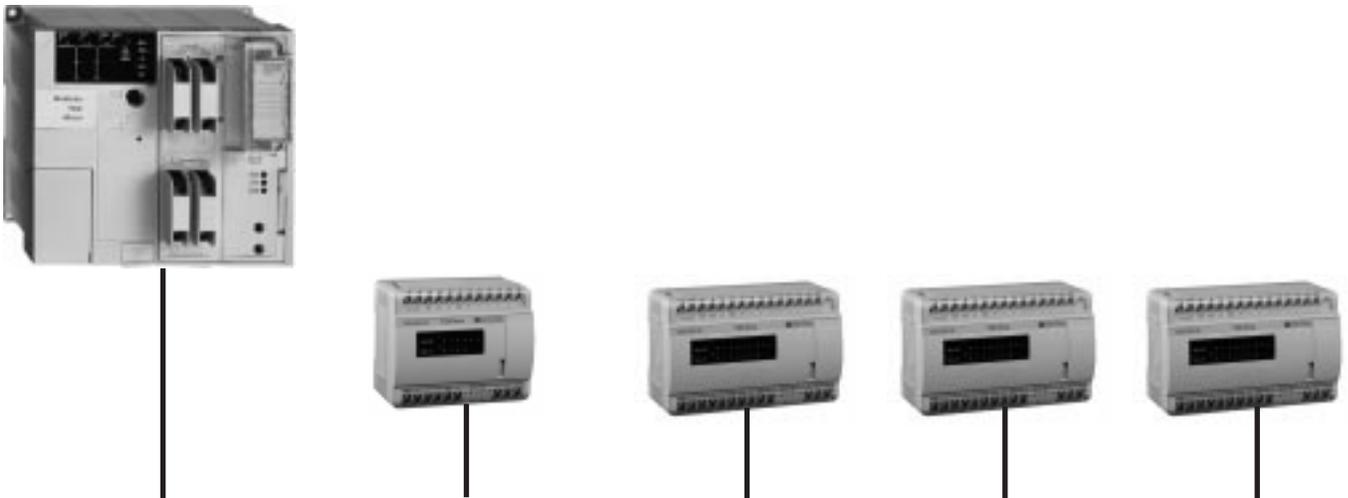
## An Integral Real-time Clock

Applications which include time-based management can easily be created using the real-time clock which is standard in the TSX Nano. Sixteen real-time schedule blocks can be programmed for daily or monthly operations by simple configuration. Date, actual time, and measurement of a period of time can all be directly accessed via the program and can be displayed on any interface terminal connected to the terminal port.

## Simple Communications

The TSX Nano can meet the increasing requirements for distributed control system structures. Four TSX Nanos can be connected together over a distance of up to 600 feet, and their programs can exchange data (4 words per PLC) automatically. This means that PLCs can be installed close to the sensors and actuators, enabling simple management of machine options and low wiring costs.

The Modicon TSX Nano PLC can be used as a distributed I/O block for the larger Modicon TSX Micro without special programming. To keep installation wiring costs to a minimum, up to 4 TSX Nano PLCs (that is 96 additional I/O) can be connected in remote I/O configuration at a maximum distance of 200 meters.



*Up to four TSX Nano PLCs can be connected as remote I/O without programming. Three TSX Nanos can be connected for remote processing.*



*Communications options include the ability to send and receive ASCII text, or act as a Unitelway slave, or communicate the de facto industry standard Modbus protocol.*

## **Sophisticated Yet Simple Programming Software**

- Multi-window capability
- Easy to use with either the keyboard or mouse
- Reversible Ladder and List Programming
- Two-step, point-and-click Ladder editor
- Direct, on-line programming
- Easy configuration
- Independent data files

## **A Competitive Alternative**

The TSX Nano is the competitive alternative to control systems which are created using industrial relays, combined with control system functions (counters, timers, clock, etc.)

In many cases, the unit cost of the automated system and its development are significantly reduced, and flexibility is optimized.

## **Configurations Closely Matched to Requirements**

The three TSX Nano sizes and their ability to connect them together delivers maximum flexible modularity for the number of I/O. In addition, the ratio of the number of inputs to outputs ensures that the control system engineer's needs are met without compromise. Nine configurations from 10 to 48 I/O can be created from just three standard products. Stock is thus significantly reduced and competitiveness is increased.

## **Many Integrated Functions and Features**

The TSX Nano includes as standard:

- A backup battery for RAM memory
- An EEPROM memory for storing programs
- A 24V DC sensor power supply
- An output which can be configured to generate pulse trains (control of stepper motors or heating/lighting)
- A terminal port for connection of an operator interface
- Inputs that can be configured to perform high speed counting and latching
- Built-in potentiometers

## **An International Product**

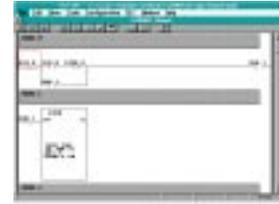
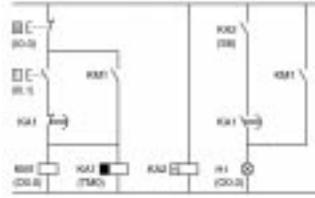
Developed in strict adherence with international standards (IEC, EN, etc.) and UL/CSA approved, the TSX Nano meets the safety and quality requirements in terms of both hardware and software.

The programming tools (FTX 117 terminal and PL7-07 software for the PC) as well as the documentation are available in five languages, underscoring the international character of the Modicon TSX Nano PLC.

# TSX Nano PLC, Programming

## Simple Applications

The example below is for a KM1 starter. After a stop, no restart is permitted for an adjustable time period (KA1). A display, H, is lit continuously while the machine is operating, and blinks during the time period in which a restart is not permitted.



```
000 LD %I0.0
001 ANDC %I0.0
002 ANDN %TM0.0
003 OR %O0.1
```

```
004 )
005 ST %O0.1
006 IN %TM0
007 LD %S6
```

```
008 AND %TM0.0
009 OR %O0.1
010 ST %O0.0
011 END
```

## Software Characteristics

### PLC Characteristics

- Program memory, 1000 instructions maximum
- Scan: normal or periodic
- Protected data memory, 256 internal words, 64 constant words, 128 internal bits
- Execution time: 0.2  $\mu$ s for an elementary instruction

### Combinational List Instructions

**LD, LDN, LDR, LDF:** read the state of a bit (direct, inverse, rising and falling edges)  
**ST, STN, R, S:** update and output (direct, inverse, set, reset)  
**AND, ANDN, ANDR, ANDF:** logic AND with a bit (direct, inverse, rising and falling edges)  
**OR, ORN, ORR, ORF:** logic OR with a bit (direct, inverse, rising and falling edges)  
**AND (,) OR(,):** open and close parentheses (nested up to eight levels)  
**XOR, XORN, XORR, XORF:** exclusive OR with a bit  
**MPS, MRD, MPP:** memory stack management  
**MCR, MCS:** master relay

### List of Grafcet Instructions

**- \* - i :** step ( $1 \leq i \leq 62$ )  
**= \* = i :** initial step ( $1 \leq i \leq 62$ )  
**#i :** activates the step i  
**# :** deactivates the current step  
**#Di :** deactivates a step i from another step  
**= \* =POST:** start of post-processing  
**Xi :** bit associated with the step

### Contact Networks

10 contacts with 1 output per line  
 N/O, N/C, rising and falling edge contacts  
 Direct, inverse, SET, RESET, coils  
 Program jump coils, program call coils

### Standard Function Blocks

32 Timers: **TMi**, 0 to 9999, TP/TON/TOF type time base: 1 ms, 10 ms, 100 ms, 1 s or 1 mn  
 16 Up/down counters: **Ci**, 0 to 9999  
 4 LIFO or FIFO registers, 16 bits: **Ri**  
 4 Drum controllers: **DRI**, ( $0 \leq i \leq 3$ ) 16 steps

### Dedicated Function Blocks

Schedule blocks : **RTCi** ( $0 \leq i \leq 15$ ) month, day, hour, minute, on PLCs with 16 and 24 I/O  
 MSG message transmission control  
**SBRi** shift register bit ( $0 \leq i \leq 3$ )  
**SCi** step by step block ( $0 \leq i \leq 3$ )

### Numerical Instructions

**+, -, /, \*, REM:** Addition, subtraction, division, multiplication, remainder division  
**SQRT:** Square root  
**INC:** Increment  
**DEC:** Decrement  
**AND/OR:** Word-wise logical operators

### Program Instructions

**END, ENDC, ENDCN:** program end (conditional or unconditional)  
**JMP, JMPN, JMPCN:** jump to a label (conditional or unconditional)  
**SRn:** call to subroutine n ( $0 \leq n \leq 15$ )  
**RET:** subroutine end

## Special Functions

100  $\mu$ s/3 ms/12 ms programmable filter outputs  
 Latching inputs which can be configured (6 inputs)  
 Input for PLC RUN/STOP control  
 Fast counting inputs (10 kHz), frequency meter (5 kHz) or for up/down counting (1 kHz)

Status output at PLC fault  
**PLS** pulse generator output (4.9 kHz maximum)  
**PWM** Pulse width modulation output (4.9 kHz maximum)  
 Threshold outputs associated with fast counting.

# Applications

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## Operator Interface

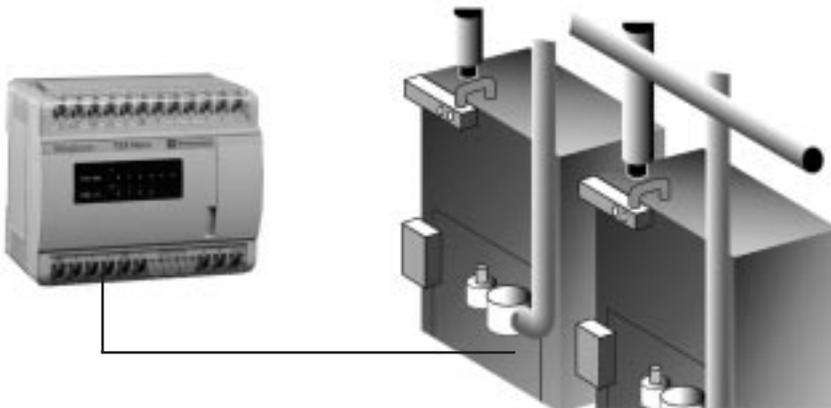


A display is continuously available to the operator, providing information on the production process. In real time, the user can intervene as soon as an anomaly appears. The operator terminal, connected to the TSX Nano terminal port can:

- Display messages stored in the terminal at the request of the PLC
- Modify settings (bits or words) stored in the PLC data memory
- Receive messages coming from the TSX Nano for display

---

## Programming the Timer



TSX Nanos with 16 and 24 I/O have 16 schedule blocks, for which internal and external outputs can be defined.

They enable the user to control outputs directly (to open and close electrical circuits), or to perform operations on a user program according to the time (month, day, hour, minute.)

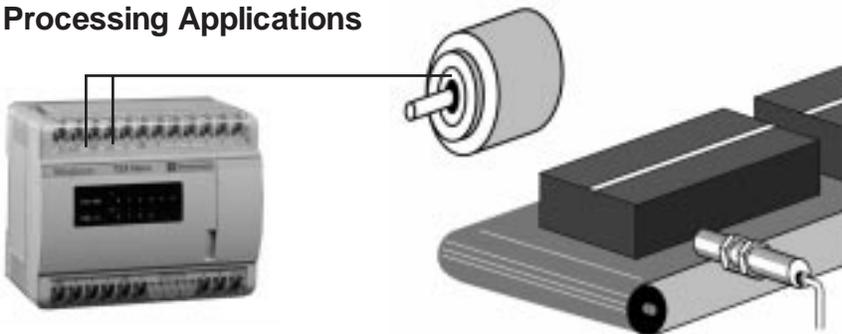
The TSX Nano provides various programming possibilities, such as time references which can be modified via the operator console or calculated by the program, etc.

The TSX Nano also enables events to be date-stamped and time calculations to be performed by the program.

The TSX Nano is suitable for control systems managing lighting, heating or sprinkler systems.

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## Fast Processing Applications

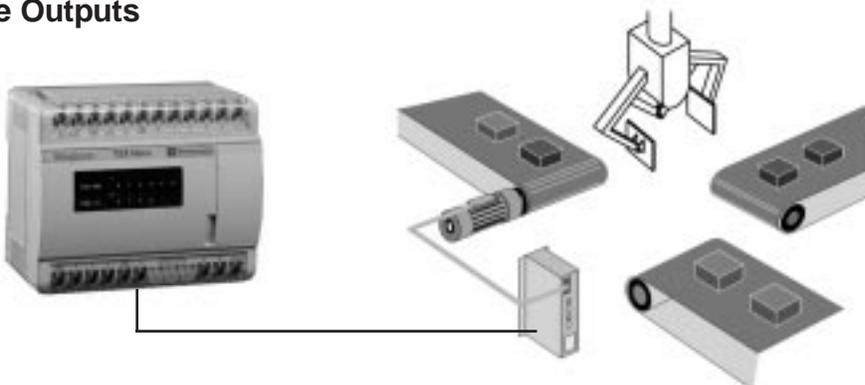


The TSX Nano includes special functions, which are simple to use and can be easily adapted for control systems which require counting capacity, or call for short response times.

- Latching, filtering of 24V DC inputs with user definable parameters (100  $\mu$ s, 3 ms or 12 ms)
- Fast counter (10 kHz max), up/down counter (1 kHz max), with 2 reflex outputs which are controlled directly by the counter function (counting capability 65535 points.)

---

## Pulse Outputs



With the PWM and PULSE software functions, the first output from the TSX Nano can be used as:

- Pulse width modulation output in a predefined frequency (19 kHz to 4.9 kHz) for applications with light or sound intensity control (dimmer function)
- Pulse generator output (19 kHz to 4.9 kHz) for control of stepper motors

When using these functions, it is necessary to use the transistor output models (which have unlimited number of operations.)

# TSX Nano-PLC, Characteristics

## Configurations

### Base PLCs

**10 I/O**  
6 Inputs  
4 Outputs



**16 I/O**  
9 Inputs  
7 Outputs



**24 I/O**  
14 Inputs  
10 Outputs



### Base PLCs with I/O extension

**20 I/O to 48 I/O**  
12 to 24 Inputs  
8 to 20 Outputs



## Characteristics

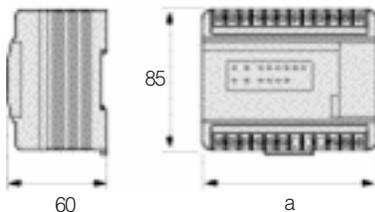
Common Characteristics		100 to 240V AC		24V DC
Supply	Nominal	V	100 to 240 - 50/60 Hz	24V DC
Voltage	Limit	V	85 to 264 - 47 to 63 Hz	DC 19.22 to 30 (ripple included)
Conform to	IEC 1131	-	Yes	Yes
Temperature	Operation	°C	+5 to +60	-25 to +70
	Storage	°C	-25 to +70	-25 to +70
Relative Humidity		%	5 to 95	5 to 95

Input Characteristics		115V AC		24V AC
Nominal	Voltage	V	110 to 120	24V DC
Input	Current	mA	10	7
Values	Supply	V	-	24V DC
	sensors	mA	-	150
Logic			-	Positive or negative depending on wiring
Input Type		-	Conforms to IEC 1131 type 1	Resistive conforms to IEC 1131 type 1

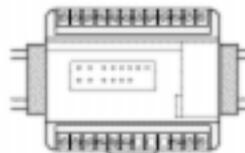
Output Characteristics		Relays		Positive Logic Protected Transistors	Negative Logic Unprotected Transistors
Loads (Nominal)	Voltage	V	24V AC to 220, 24	24V DC	24V DC
	Nominal current	A	-	0.5	0.5
Values	Tungsten lamp	W	-	≤10	≤10
DC Loads	Current	A	DC12 1-24V (0.2 x 10 <sup>6</sup> ops)	0.625 for U 30 V	0.625 for U 30 V
			DC13 0.4-24V (1 x 10 <sup>6</sup> ops)	- common for loads	+ common for loads
AC Loads	AC 12 resistive current	A	AC12 1-110/220V (0, 2 x 10 <sup>6</sup> ops)	-	-
			0.5-110/220V 2 x 10 <sup>6</sup> ops)		
			1-48V (0.5 x 10 <sup>6</sup> ops) 2-24V (0.5 x 10 <sup>6</sup> ops)		
	AC15 inductive current	A	AC15 0.22-220V (1 x 10 <sup>6</sup> ops) 0.45-24/48/110V (1 x 10 <sup>6</sup> ops) 1-24V (0.2x10 <sup>6</sup> ops)	-	-

## Dimensions, Mounting

TSX 072 • • • •

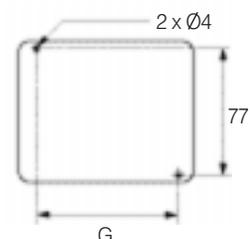


Rail mounted  
AM1-DP or AME-DE



Requires 2 plastic plugs

Plate mounted  
AM1-PA



# References



TSX 0720 10••



TSX 0721 16••



TSX 0721 1648



TSX 0721 24••



T FTX 117 07/117 1

## TSX Nano PLCs, DC 24V Supply (1)

Number of I/O	Inputs	Relay Outputs	24V DC 0.5 A transistor outputs	Version 2 Part Number (3)	Version 3 Part Number (3)	Weight (kg)
10	6 DC 24V	4	–	<b>TSX 0720 1022</b>	<b>TSX 0730 1022</b>	0.290
			4 protected, source	<b>TSX 0720 1012</b>	<b>TSX 0730 1012</b>	0.270
			4 unprotected, sink	<b>TSX 0720 1002</b>	<b>TSX 0730 1002</b>	0.270
16	9 DC 24V	7	–	<b>TSX 0721 1622</b>	<b>TSX 0731 1622</b>	0.350
			7 protected, source	<b>TSX 0721 1612</b>	<b>TSX 0731 1612</b>	0.325
			7 unprotected, sink	<b>TSX 0721 1602</b>	<b>TSX 0731 1602</b>	0.325
24	14 DC 24V	10	–	<b>TSX 0721 2422</b>	<b>TSX 0731 2422</b>	0.400
			10 protected, source	<b>TSX 0721 2412</b>	<b>TSX 0731 2412</b>	0.370
			10 unprotected, sink	<b>TSX 0721 2402</b>	<b>TSX 0731 2402</b>	0.370

## TSX Nano PLCs, AC 100/240 V Supply (1)

Number of I/O	Inputs	Relay Outputs	24V 0.5 A transistor outputs	Version 2 Part Number (3)	Version 3 Part Number (3)	Weight (kg)
10	6 DC 24V	4	–	<b>TSX 0720 1028</b>	<b>TSX 0730 1028</b>	0.300
			4 unprotected, sink	<b>TSX 0720 1008</b>	<b>TSX 0730 1008</b>	0.280
16	9 AC 115V	7	–	<b>TSX 0721 1648</b>	<b>TSX 0731 1648</b>	0.390
			9 DC 24V	7	<b>TSX 0721 1628</b>	<b>TSX 0731 1628</b>
	–	7 unprotected, sink	<b>TSX 0721 1602</b>	<b>TSX 0731 1602</b>	0.335	
24	14 DC 24V	10	–	<b>TSX 0721 2428</b>	<b>TSX 0731 2428</b>	0.410
			10 unprotected, sink	<b>TSX 0721 2402</b>	<b>TSX 0731 2402</b>	0.380

## FTX 117 Programming Terminals with Back-Lit 4-line LCD Screen (1)

Programmable Operations	TLX manual DM 07 117E	TSX 07 connecting cable, Length 2 m	Reference	Weight (kg)
Hand Held Terminal	Not Provided	Not Provided	<b>T FTX 117 0</b>	0.300
	Not Provided	Provided	<b>T FTX 117 07 1</b>	0.400
	Provided	Provided	<b>T FTX 117 0 1 E</b>	0.665

## DOS Software

Description	Support	Includes	Reference	Weight (kg)
Software Package	FTX 417/	1 3" 1/2 diskette	<b>TLXLPL707F10E (Ver 2)</b>	0.430
Reversible List/	FTX 507	1 RS485 connecting cable	<b>TLXLPL707F30E (Ver 3)</b>	
Ladder Language		1 installation manual		
	IBM PC,	1 3" 1/2 diskette	<b>TLXLPL707P10E (Ver 2)</b>	0.440
	IBM PS/2,	1 RS232 connecting cable (2)	<b>TLXLPL707P30E (Ver 3)</b>	
	Comp. PC	1 user manual		

## Miscellaneous Accesories

Description	Length (m)	Use	Reference	Weight (kg)
Input Simulator DC 24V	–	TSX Nano 10 I/O	<b>TSX 07 SIM 06</b>	0.050
	–	TSX Nano 16 I/O	<b>TSX 07 SIM 09</b>	0.070
	–	TSX Nano 24 I/O	<b>TSX 07 SIM 14</b>	0.080
Analog Modules	–	Analog Input 0-10 V	<b>TSX AEN 101</b>	0.265
	–	Analog Input 4-20 V	<b>TSX AEN 102</b>	0.265
	–	Analog Input +/- 10 V	<b>TSX AEN 105</b>	0.265
	–	Analog Output 0-10 V	<b>TSX ASN 101</b>	0.265
	–	Analog Output 4-20 V	<b>TSX ASN 102</b>	0.265
	–	Analog Output +/- 10 V	<b>TSX ASN 105</b>	0.265
AC/DC Adapter for FTX 117 Terminal	–	AC 110/120V AC power supply	<b>T FTX ADC 11</b>	0.260
	–	AC 200/240V AC power supply	<b>T FTX ADC 12</b>	0.260
Connecting Cable	0.30	I/O extension	<b>TSX CAO 003</b>	0.015
	2	FTX 117 <-> TSX Nano	<b>T FTX CB1 020</b>	0.100
	5	FTX 117 <-> TSX Nano	<b>T FTX CB1 050</b>	0.190
Memory Card–Credit Card Format Self Teach	EEPROM	32 K words	<b>T FTX REM 3216</b>	0.025
	–	Protected RAM 32 K words	<b>T FTX RSM 3216</b>	0.030
	–	Protected RAM 128 K words	<b>T FTX RSM 12816</b>	0.030
	Including:	1 TSX 07 (16 I/O), 1 input simulator 1 FTX 117		
Documentation (in English)		TSX Nano/FTX 117 user's manual	<b>TLX DM 07 117 E</b>	0.265
		TSX Nano/PC Software user's manual	<b>TLX DM 07 DS E</b>	0.320
		TSX Nano/FTX 117 self teach manual	<b>MDI TSX 07 1 E</b>	0.280

(1) A multilingual aide pocket reference is included as standard (in English, French, German, Italian, and Spanish).

(2) 2m cable equipped with a 9-pin SUB-D male connector at the PC end.

(3) Version 3 PLCs and software, available by the second quarter of 1997, have Modbus communication support and support for the Analog Modules. Version 2 applications will be fully compatible with Version 3 hardware and software.

**Schneider Automation Inc.**

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