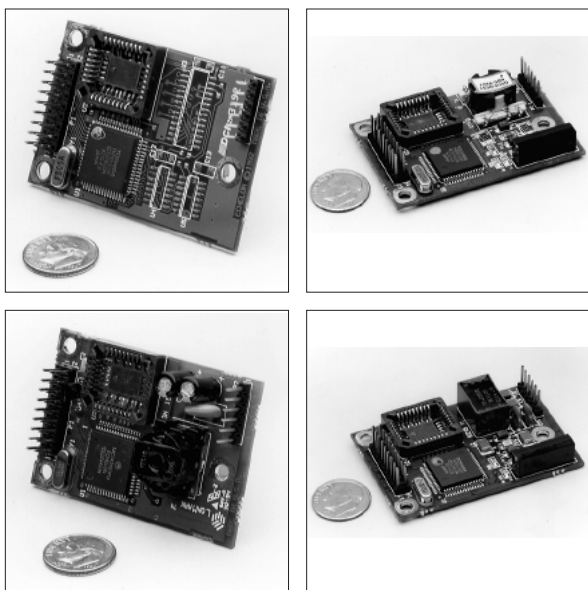# Twisted Pair and Generic Control Modules
## Models 55010-00, 55010-10, 55020-01, 55020-10, 55030-10, 55010R-00, 55010R-10, 55020R-01, 55020R-10, and 55030R-10



- ▼ On-board Neuron 3150 Chip
- ▼ Local event processing
- ▼ Differential Manchester encoded signaling for polarity-insensitive network wiring
- ▼ Transformer-isolation
- ▼ 78 kilobits per second (TP/FT-10, TP-FT-10F, TP/XF-78, TP/XF-78F) and 1.25 megabits per second (TP/XF-1250) network bit rates
- ▼ Distances up to 500 meters worst case[1] in free topology (TP/FT-10, TP/FT-10F)
- ▼ Distances up to 2700 meters worst case[1] in doubly terminated bus topology (TP/FT-10, TP/FT-10F)
- ▼ Flash memory support on TP/FT-10F and TP/XF-78F
- ▼ Common form factor makes control modules interchangeable
- ▼ Low power consumption
- ▼ Designed to comply with FCC and VDE Level B requirements
- ▼ UL, CSA, TÜV Recognized components (TP/XF-78F pending)
- ▼ LONMARK® certifiable

## Description

Control modules provide a simple, cost-effective method of adding LONWORKS® technology to any control system. A control module consists of a miniature circuit card containing a Neuron® 3150® Chip, PROM, or flash (TP/FT-10F, TP/XF-78F) memory socket, a communication transceiver, and connectors for power, I/O, and the network. Three transceiver options are available for twisted pair control modules:

- • Free topology, transformer-isolated, 78kbps, differential Manchester encoded (TP/FT-10, TP/FT-10F);
- • Transformer-isolated, 78kbps, differential Manchester encoded (TP/XF-78, TP/XF-78F);
- • Transformer-isolated, 1.25Mbps, differential Manchester encoded (TP/XF-1250).

The small size of the control modules permits them to be mounted on or inside an OEM's product, directly adjacent to the sensors, outputs, or displays that the module will control.

Using the control modules can save hundreds of hours of development time compared with designing custom modules. The control modules are designed to comply with both FCC and VDE Level B requirements, minimizing time-consuming and expensive laboratory testing, component selection, and layout redesign work. As UL, CSA, and TÜV Recognized components, the control modules can be integrated into a product with minimal additional safety testing.

Models 55010R-00, 55010R-10, 55020R-01, 55020R-10, and 55030R-10 are compliant with the European Directive 2002/95/EC on the restriction of the use of certain hazardous substances (RoHS) in electrical and electronic equipment.

All control modules are the same size and use the same wiring connectors, allowing the user to change communication speeds and transceivers without developing new modules. This design also allows the modules to be exchanged for one another without modifying the application electronics motherboard.

The control modules are supplied as compact circuit boards already including the surface-mount technology (SMT) Neuron 3150 Chip, eliminating the need for the customer to operate an SMT board assembly operation. The control modules are economically priced for both low and high volume users.

The TP/FT-10, TP/FT-10F, TP/XF-78, and TP/XF-78F modules communicate at 78kbps, the TP/XF-1250 at 1.25Mbps. All of the modules provide high speed throughput to meet a wide range of control applications. The Neuron 3150 Chip is operated at a 5MHz clock speed on the TP/FT-10 and TP/XF-78 modules, and at 10MHz on the TP/FT-10F, TP/XF-78F and TP/XF-1250 modules.

The TP/FT-10F and TP/XF-78F modules include circuitry to support an Atmel 29C257 (32K) or 29C512 (64K total, 56K usable), or 29C010A (128K total, 56K usable, 72K unusable)

flash memory. This feature allows new parameters and applications to be downloaded into the module via the network, and is ideal for applications that require field programming changes or where nodes will be physically inaccessible.

The TP/FT-10, TP-FT/10F, TP/XF-78, TP/XF-78F, and TP/XF-1250 modules use a transformer to isolate them from the twisted pair network cable. This design provides excellent common mode rejection and permits the system to operate in electrically noisy environments. It also reduces the susceptibility of the system to ground loops caused by the use of multiple node power supplies that are floating relative to ground. This architecture makes these modules ideal for communicating over long distances in industrial environments.

Echelon offers a comprehensive range of development tools, network interfaces, routers, and network services tools to simplify the task of designing and commissioning products using the control modules. Technical support for the modules is available through Echelon's technical support program.

## Connectors

**18-Pin I/O (P1) — All Modules**

| Function | Pin |
|---|---|
| N/C | 1 |
| IO 0 | 2 |
| GND | 3 |
| IO 1 | 4 |
| GND | 5 |
| IO 2 | 6 |
| GND | 7 |
| IO 3 | 8 |
| ~RESET | 9 |
| IO 4 | 10 |
| IO 5 | 11 |
| +5V | 12 |
| IO 6 | 13 |
| IO 9 | 14 |
| IO 7 | 15 |
| IO 10 | 16 |
| IO 8 | 17 |
| ~SERVICE | 18 |

**6-Pin Network (P2) — TP/FT-10, TP/FT-10F**

| Function | Pin |
|---|---|
| NC | 1, 2, 5, 6 |
| DATA B | 3 |
| DATA A | 4 |

**6-Pin Network (P2) — TP/XF-78, TP/XF-78F, TP/XF-1250**

| Function | Pin |
|---|---|
| CT B | 1 |
| CT A | 2 |
| DATA B | 3 |
| DATA A | 4 |
| N/C | 5, 6 |

## Female Connector Part Numbers

| Supplier | 18-pin (2 x 9) (P1) | 6-pin (1 x 6) (P2) |
|---|---|---|
| Samtech S | SW-109-01-T-D | SSW-106-01-TS |
| Advanced Interconnections | BC-009-124TL | BC006-123TL |
| Methode | 9000-209-303 | 9000-106-303 |

## Sources for 32K X 8 OTP ROM TP/FT-10, TP/XF-78

**(32-LEAD JEDEC PLCC PACKAGE )**

| Supplier | 5 MHz Clock (150-200ns) |
|---|---|
| AMD | AM27C256-200JC |
| Atmel | AT27C256R-20JC |
| Intel | N27C256-20/L |
| Microchip | 27C256-20/L |
| National | NMC27C256.20 |
| Signetics | 27C256-20A |
| Texas Instruments | TMS27C256.20 |

## Sources for Flash Memory TP/FT-10F, TP/XF-78F

**(32-LEAD JEDEC PLCC PACKAGE )**

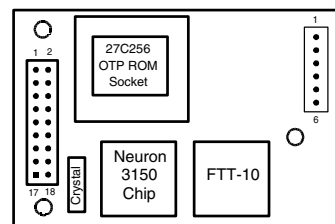| Supplier | 10 MHz Clock ($t_{DS}$²35ns) |
|---|---|
| Atmel | AT29C257-90JC (32K x 8) |
| Atmel | AT29C512-90JC (64K x 8, 56K usable) |
| Atmel | AT29C010A-90JC (128K x 8, 56K usable) |

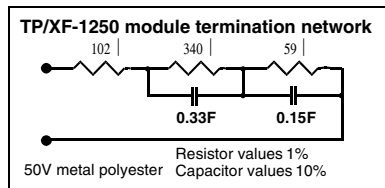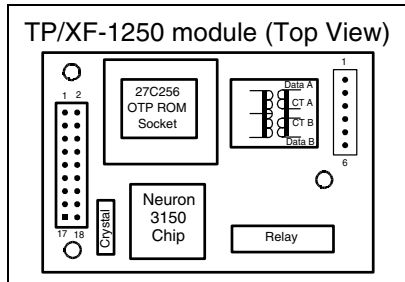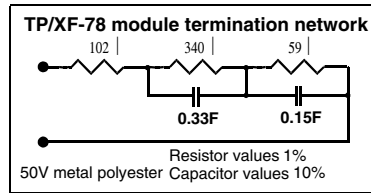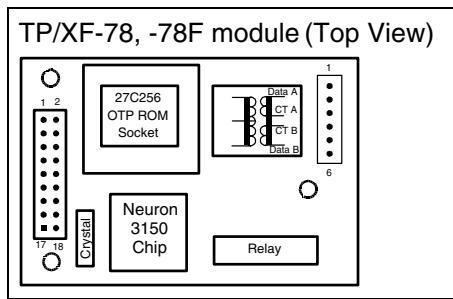## Sources FOR 32 K X 8 OTP ROM TP/XF-1250

**(32-LEAD JEDEC PLCC PACKAGE*)**

| Supplier | 10 MHz Clock (90ns) |
|---|---|
| AMD | AM27C256-90JC |
| Catalyst | CAT27HC256LN-90 |
| Microchip | 27HC256-90/L |

*\* TP/XF-1250 modules with a manufacturing date code on or before January 1995 (revision code A to G) require a memory with a 90ns access time. TP/XF-1250 modules with a manufacturing date code after February 1, 1995, (revision code H or later) require a memory with a 90ns or 120ns access time.*

TP/FT-10, -10F modules (Top View)



For termination options, consult the User's Guide.

TP/XF-78, -78F module (Top View)

1 2
27C256
OTP ROM
Socket
Data A
CT A
CT B
Data B
1
6
Crystal
Neuron
3150
Chip
Relay
17 18

TP/XF-78 module termination network

102    340    59
0.33F    0.15F
50V metal polyester Resistor values 1%
Capacitor values 10%

TP/XF-1250 module (Top View)

1 2
27C256
OTP ROM
Socket
Data A
CT A
CT B
Data B
1
6
Crystal
Neuron
3150
Chip
Relay
17 18

TP/XF-1250 module termination network

102    340    59
0.33F    0.15F
50V metal polyester Resistor values 1%
Capacitor values 10%

## Specifications

| | |
|---|---|
| Microprocessor | Neuron 3150 Chip |
| Crystal Oscillator Clock | TP/FT-10, TP/XF-78: 5MHz |
| | TP/FT-10F, TP/XF-78F, TP/XF-1250: 10MHz |
| Memory Socket and Type | TP/FT-10, TP/XF-78, TP/XF-1250: PLCC type for 32-lead JEDEC 32 KB OTP ROM |
| | TP/FT-10F, TP/XF-78F: Flash memory chip not included. Flash memory must have $t_{DS}$ 35ns. Linker will allocate 64 bytes of dedicated Neuron 3150 Chip RAM for 32K flash memory and 128 bytes of dedicated Neuron 3150 Chip RAM for 64K flash memory (56K usable, 8K unusable). |
| Data Communication Type | Differential Manchester coding |
| Transceiver Type | Transformer-isolated |
| Network Compatibility with Echelon Transceivers | TP/FT-10, TP/FT-10F: compatible with FTT-10, FTT-10A, and LPT-10. |
| | TP/XF-78 and TP/XF-78F: compatible with TPT/XF-78. |
| | TP/XF-1250: compatible with TPT/XF-1250. |
| Isolation Between Network and | 0-60 Hz (60 seconds): 1000VRMS |
| I/O Connectors[3] | 0-60 Hz (continuous): 277VRMS |
| Common Mode Range 0-60 Hz | 277VRMS |
| Typical Supply Current[4] | TP/FT-10: 25mA receive, 40mA transmit |
| | TP/XF-78: 35mA receive, 45mA transmit |
| | TP/XF-78F: 50mA receive, 60mA transmit |
| | TP/XF-1250: 55mA receive, 80mA transmit |
| Electrostatic Discharge to Network Connector[5] | TP/FT-10, TP/FT-10F: Designed to comply with IEC801-2, Level 4 |
| | TP/XF-78, TP/XF-78F, TP/XF-1250: No errors to 15kV, no hard failures to 20kV tested per MIL-STD-883 |
| EMI | Designed to comply with FCC Part 15 Level B and VDE 0871 Level B |
| Listings | UL 1950, CSA C22.2 No. 950, TÜV EN60950 |
| Transceiver Bit Rate | TP/FT-10, TP/FT-10F, TP/XF-78, TP/XF-78F: 78kbps |
| | TP/XF-1250: 1.25Mbps |
| Maximum Nodes Per Channel | TP/FT-10, TP/FT-10F:        64 (-40 to +85°C) |
| | TP/XF-78, TP/XF-78F:        64 (0 to 70°C), 44 (-40 to +85°C) |
| | TP/XF-1250[8]:        64 (0 to 70°C), 32 (-20 to +85°C), 16 (-40 to +85°C) |
| Network Wiring | TP/FT-10, TP/FT-10F: 22 to 16AWG twisted pair; see User's Guide for qualified cable types |
| | TP/XF-78, TP/XF-78F, TP/XF-1250: Level 4, 22AWG twisted pair[7] |
| Network Length in Free Topology[2] | TP/FT-10, TP/FT-10F only:    1000m (3280 feet) maximum total wire with one repeater    500m (1640 feet) maximum total wire with no repeaters    500m (1640 feet) maximum node to node distance with no repeaters |

| | |
|---|---|
| Network Length in Doubly-Terminated Bus Topology[2] | TP/FT-10, TP/FT-10F: up to 2700m (8850 feet) worst case[1]<br>TP/XF-78, TP/XF-78F: 1400m (4600 feet) worst case[1]<br>TP/XF-1250: 130m (430 feet) worst case[1] |
| Maximum Stub Length in Doubly-Terminated Bus Topology | TP/FT-10, TP/FT-10F, TP/XF-78, TP/XF-78F: 3m (9.8 feet)<br>TP/XF-1250: 0.3m (12 inches) |
| Network Bus Polarity | Polarity insensitive |
| Power-down Bus Protection | High impedance when unpowered |
| Supply Voltage | 5V ± 5% |
| I/O Connector | 2 x 9 on 2.54 mm (0.1″) centers |
| Network Connector | 1 x 6 on 2.54 mm (0.1″) centers |
| Network Termination | One terminator in free topology (TP/FT-10, TP/FT-10F only),<br>two terminators in doubly-terminated bus topology for all others |
| Operating Temperature[6] | -40 to +85°C (excluding flash memory) |
| Non-operating Temperature | -40 to +85°C |
| Operating Humidity | 25 - 90% RH @ 50°C, non-condensing |
| Non-operating Humidity | 95% RH @ 50°C, non-condensing |
| Dimensions | 61 mm x 18 mm x 41 mm (2.4″ x 0.7″ x 1.6″) |

## Ordering Information

| Product | Echelon Model Number |
|---|---|
| TP/FT-10 Module | 55020-01, 55020R-01 (RoHS-compliant) |
| TP/FT-10F Module | 55020-10, 55020R-10 (RoHS-compliant) |
| TP/XF-78 Module | 55010-00, 55010R-00 (RoHS-compliant) |
| TP/XF-78F Module | 55010-10, 55010R-10 (RoHS-compliant) |
| TP/XF-1250 Module | 55030-10, 55030R-10 (RoHS-compliant) |
| *LONWORKS Twisted Pair Control Module User's Guide* (order separately–not shipped with product) | 078-0015-01 |

*Notes:*

*1. Worst case distance figures are based on variations in node distribution, node temperature, node voltage, wire characteristics, transceiver characteristics, and Neuron Chip characteristics, and allow for an average wire temperature of up to +55°C.*

*2. Network length for TP/FT-10 varies depending on wire type. See LonWorks FTT-10 Free Topology Transceiver User's Guide for detailed specifications.*

*3. Safety agency hazardous voltage barrier requirements are not supported.*

*4. These figures include typical PROM current consumption of 4mA @ 5MHz or 5mA @ 10MHz. During flash memory write cycles an additional 50mA will be consumed by the TP/XF-78F module. These figures exclude current due to loading on the I/O connector pins.*

*5. The I/O pins of P1 connect directly to the Neuron Chip and do not contain additional protection beyond what is available with a typical advanced CMOS device.*

*6. See Motorola or Toshiba Neuron Chip Data Book for operational temperature limitations of the Neuron Chip. In particular, versions of the Neuron Chip may be unable to write to the EEPROM at temperatures below -20°C, even though all other non-write operations are supported at -40°C.*

*7. For wire specifications, see Junction Box and Wiring Guidelines for Twisted Pair LonWorks Networks, 005-0023-01 Rev D or later.*

*8. Wiring topology restrictions apply to TP/XF-1250 modules for proper operation. No more than eight (8) TP/XF-1250 modules may be located within any sixteen (16) meter section of bus cable. Topology restrictions apply to TPM-1250 SMX Transceiver Modules as well, and each TPM-1250 module equals two TP/XF-1250 or TPT/XF-1250 modules from the perspective of number of devices on a channel.*

*\* Neuron Chips and Control Modules were not designed for use in equipment or systems which involve danger to human health or safety or a risk of property damage and Echelon assumes no responsibility or liability for use of the Neuron Chips or Control Modules in such applications.*