MAXIFLEX T2 CPU's

Models M1240B (T2), M1241B (T2c), M1242B(T2e) & M1243B (T2m)
Telemetry and Remote I/O Processors

DATASHEET

FEATURES

- **Designed specifically for Remote I/O Systems**

- **System sizes from 2 to 15 I/O modules per CPU**

- **No programming required but available for local control.**

- **Easy configuration using free software utility.**

- **Optional integral Ethernet, CONET or radio modem Port**

- **Automatic I/O module identification and scanning.**

- **Built in CONET inter-network routing for complex systems.**

- **Built in Modbus protocol support for 3rd party connectivity**

The MAXIFLEX T2 CPU is designed specifically for remote I/O applications, offering powerful industrial network communications features with ease of use.

All local data is accessible through up to 64000 Data Interchange Registers in a single "Data Interchange Table".

All system configuration data and dynamic data can be read and written through this convenient table interface.

Conventional remote I/O systems can be implemented without the need for any programming, although the inclusion of programming capability in the T2 with the powerful EziForth programming language allows local control functions to be performed.

Following the ISO OSI 7-layer model, this CPU includes a powerful inter-network routing capability for retrieving data from the corners of the factory in very large , geographically spread-out installations. This capability allows many dissimilar network types to be linked to create a seamless factory intranet, quite often without the need to layer special network cabling.

The T2 CPU automatically identifies the presence of I/O modules and performs I/O scanning of these modules, making this data available in the Data Interchange Table without needing to write a line of code.

Many other features such as a built-in real-time clock, battery backup for temporary dynamic data, and a MODBUS equipped RS232/485 serial port are standard in this product.

APPLICATIONS

- **Remote I/O for SCADA software packages using Ethernet. Use with CONET to retrieve data over distances up to 10km.**

- **Point-to-Point Telemetry systems with analog and digital data in both directions over a single pair of wires.**

- **I/O expansion into existing DCS installations through the CONET network and Modbus gateways.**

- **Third party network interfaces to the DCS over CONET to achieve a rugged plant intranet.**

- **Radio linked RTU out-stations with up to 480 I/O per out-station.**

- **High Density Analogue Data Acquisition systems such as boiler skin temperature monitoring with direct sensor connections.**

- **Distributed Alarm Systems with Time-stamping to 10 milliseconds at source.**

- **Dialup monitoring of remote installations for metering, asset management or security applications.**

LED Indicators

A comprehensive set of LED indicators are used for status indication on the front of the CPU. These identify:

- **CPU Healthy**
- **I/O Module Status**
- **RUN Application program started**
- **Battery Status**
- **Serial Port Communications Activity**
- **Network Communications Activity**

AutoScan

The T2 CPU is equipped with "Autoscan", a feature that automatically scans all the I/O Modules and I/O connected to the CPU. The power of this feature is seen in Telemetry applications and Data Acquisition where it obviates the need for application programs in these roles. Using "Autoscan", the CPU scans all conventional I/O modules installed on the MAXIFLEX base, sorts the data into convenient tables according to type of I/O (Analogue or Digital; Input or Output) and copies this data to/from the CPU's Data Interchange Table (DIT) for easy access from any of the network ports. SCADA, DCS or other devices can read/write the Data Interchange table in efficient blocks without CPU programming required.

I/O Module Configuration Management

I/O Module Configuration Management is included in all of the T2 CPU's. This function is responsible for continuously monitoring all slots of the MAXIFLEX I/O base. A copy of all intelligent I/O module setup data is kept in the CPU. If any I/O modules is changed, the CPU will automatically update the new module with its configuration. This allows I/O modules to be changed without the need to reconfigure them. (e.g. a TC module with different TC types and set points selected.)

(Network Interface Modules installed on the MAXIFLEX base are equipped with their own configuration storage and are not updated from the CPU when replaced.)

I/O Manifesto Feature

This function is responsible for continuously monitoring all slots of the MAXIFLEX I/O base, keeping track of the currently installed module types. This list is compared against the required list (the I/O manifesto) configured by the user. Any change in module positions will be detected. This I/O status is displayed on the front of the CPU, and is available as an alarm status register in the Data Interchange Table. This status can also be read through any of the network ports.

DIT Service

The Data Interchange Table (DIT) in the CPU is the focal point for data storage in the CPU. Any exchange of data between functions in the CPU and with the outside world takes place through the DIT.

The DIT is an array of 16 bit registers accessible from any function or communications port in the system for interchanging data.

The T2 CPU has a "dynamic" DIT area comprising of 3250 data registers used for temporary storage of normal dynamic data, and a non-volatile "static" DIT area of 1500 registers used to store configuration data for the system.

In addition, every I/O module position has up to 4000 registers reserved for its use.
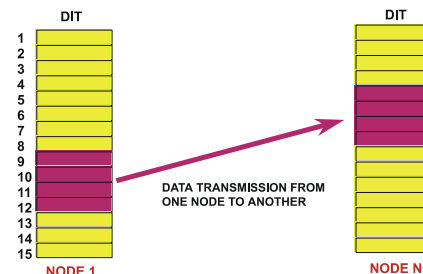
The total addressable range of 65,500 registers allows the Data Interchange Tables in any module in the system, including Network Interface Modules, to also be directly addressable through any of the CPU ports.

Subscription Service

Central to many applications involving communications across networks is the need to replicate data between nodes on the network. The subscription service provides an easy to use but extremely powerful data replication ability between DIT's in the system, whether they are local or remote.

This service provides change-of-state detection and error reporting for optimum performance and reliability.

Examples include SCADA systems acquiring data from remote telemetry units in the field to a central point; or a point-to-point telemetry application, where inputs are transmitted from one location to outputs at another location.

In all these cases, the traditional method is for a controlling master node to poll the slave nodes regularly for data in case something has changed. This crude method is an inefficient use of the limited network bandwidth, and is inherently slow in typical update times. The MAXIFLEX T2 CPU provides a superior mechanism to accomplish this commonly used function, through its Subscription Service.

The receiving node is configured to request the data from the source node, by setting up a subscription, very much like you would subscribe to a magazine through your newsagent. A subscription can be a single register or a block of up to 64 registers which you wish to receive on any change of state and/or at a regular time interval.

Each T2 CPU can be configured to subscribe to 32 data blocks as receiver, and be requested for up to 8 data blocks as transmitter.

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CONET Technology

The T2 CPU's are all equipped with the field proven CONET industrial intranet technology.

CONET is a peer-to-peer internetworking technology designed from the ground up for noisy industrial plant environments.

CONET can run on a number of physical media including existing plant cabling, conventional copper twisted pair, over radio links, over fibre-optic links, over virtual serial links, and over Ethernet.

CONET is available for the following media:

- **Conet/c** is used over copper bus systems including twisted pair and industrial instrumentation cabling. This is a full-function token-passing peer-to-peer network technology that runs on conventional twisted pairs.
  The T2c CPU is equipped with a Conet/c port.

- **Conet/s** is used over point-to-point virtual full-duplex serial links, including fibre-optic links or through modems for wide area applications. This full duplex protocol provides full peer-to-peer communications capability to allow multiple local networks systems to be interconnected over a wide area into a single intranet. This efficient protocol retains the full capability of the CONET inter-networking technology including remote programming, event message handling and the ability to run data subscriptions in both directions simultaneously. Any virtual serial link supporting full duplex communications can be used as a full peer-to-peer link in the CONET intranet. The serial port on all T2 CPU's can be set for the Conet/s protocol.

- **Conet/m** is used over UHF/VHF radio links. This is a peer-to-peer packet-radio protocol using a Multiple Access protocol with random back-off to effect channel access. Using "Digipeating" technology, Conet/m allows relaying of data packets through up to six intermediate MAXIFLEX RTU's. This indirect means of communication is extremely useful in cases where terrain and obstructions may affect communications to some RTU's. Inaccessible RTU's can be accessed by hopping the data packet between intermediate RTU's.
  The T2m CPU is equipped with a Conet/m port.

- **Conet/e** is used over TCP/IP Ethernet networks. This protocol encapsulates all of the standard CONET message types in packets for transmission over Ethernet.
  The T2e CPU is equipped with an Ethernet Port.

The CONET message protocol allows for remote programming, time-stamped at source event messaging, data replication using the subscription service, as well as the more conventional data polling access methods.

CONET Inter-Network Routing

Many systems are constructed of multiple networks to overcome the difficulties of topology or communication protocol conversion. The CONET Network Routing service provides a means to seamlessly interconnect these networks into an integrated "intranet" so that any node in the system may be globally addressed from any other without regard for its physical location or network segment.

This feature also allows redundant network paths to be implemented.

CONET Router Wizard

The CONET Router Wizard is a user-friendly spreadsheet based software utility, used to calculate the router table register entries for all router Nodes in a MAXIFLEX intranet system.

A router node exists wherever two CONET equipped Networks are connected to the same CPU/IO system. Simply make a sketch of the Intranet, numbering each network. Identify the communications port on the MAXIFLEX CPUs and Network Interface Modules (NIM's) connected to each network.

The CONET Router Wizard then calculates the Network Routing Table register entries for each CPU in the system acting as a network router.

Enter these values into the CPU DIT to invoke the Network Routing Capability.

Global Addressing can then be used on the MAXIFLEX Intranet.

Router Wizard System Interconnection Table

Calculated Router Table Register Entries

Serial Port Protocol Selection

The included serial port on the T2 CPU's comes equipped with four protocol options as standard:

- **Modbus Slave** can be selected for easy interconnection of MAXIFLEX I/O to third party systems such as Distributed Control System's, SCADA software, or Master Programmable Logic Controllers.

- **Modbus Master** can be selected for reading/writing data to third party intelligent devices such as controllers, analysers, and PLC' equipped with te Modbus Slave protocol.

- **Conet/s protocol** can be selected to interconnect MAXIFLEX systems over wide areas using the RS232 port. This full duplex protocol provides full peer-to-peer communications capability to allow multiple local networks systems to be interconnected over a wide area into a single intranet. This efficient protocol retains the full capability of the CONET inter-networking technology.

- **Custom Port Protocol Definition.** The T2 CPU supports custom protocols on the serial port. In order to use this advanced feature of the T2 CPU, , download the custom protocol driver to T2 CPU and select the "User" Protocol type. Consult the factory for available protocols, or for assistance in developing your own protocol using the powerful EZIFORTH programming language.

Ethernet Port Protocol Selection

The Ethernet port included on the T2e CPU comes equipped with three protocol options as standard:

- **Modbus ASCII Slave** can be selected for easy interconnection of MAXIFLEX I/O to third party systems that support Modbus Master protocol, using virtual serial port driver software. This allows, for example, conventional SCADA packages equipped with a conventional Modbus driver to communicate over Ethernet with the T2e CPU using Serial Port Redirector software loaded on the SCADA PC.

- **Modbus/TCP** can be selected to interconnect MAXIFLEX systems over Ethernet to SCADA software equipped with Modbus/TCP drivers. This protocol option conforms to Class 0 of the Modbus/TCP conformance classification.
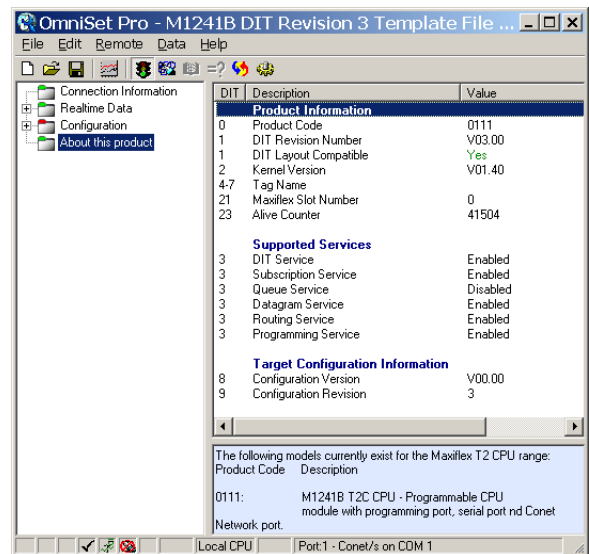
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Remote Programming Service

Every CPU is equipped with a dedicated programming port that is equipped with the Conet/s protocol. Using the network routing function and convenient table configuration, it is possible to configure/program every node in a MAXIFLEX intranet remotely from a single programming port. This function significantly reduces system downtime and improves maintenance efficiency and therefore life-cycle costs. Engineering access to the Network is simple and can be made at any point on the network enabling nodes to be reprogrammed remotely via any of the T2 CPU ports.

PC Configuration Omniset/Omniset Pro

Most of the features available on the T2 CPU can be configured with the minimum of effort by writing to Data Interchange Registers in the CPU. This is made easy using the Microsoft Windows95/98/NT/2000/XP(Home)/ XP(Pro)/Vista(Home)/Vista(Business) compatible Omniset or Omniset Pro configuration software utilities. The Omniset utility is supplied free of charge for this purpose. Omniset utility is supplied as part of the CONET EXPLORER SUITE, which is required for programming of the T2 CPU using EziForth Programmer's Workbench *(model:CC031A)*.

It is also possible to configure a T2 CPU through any of its communications ports.

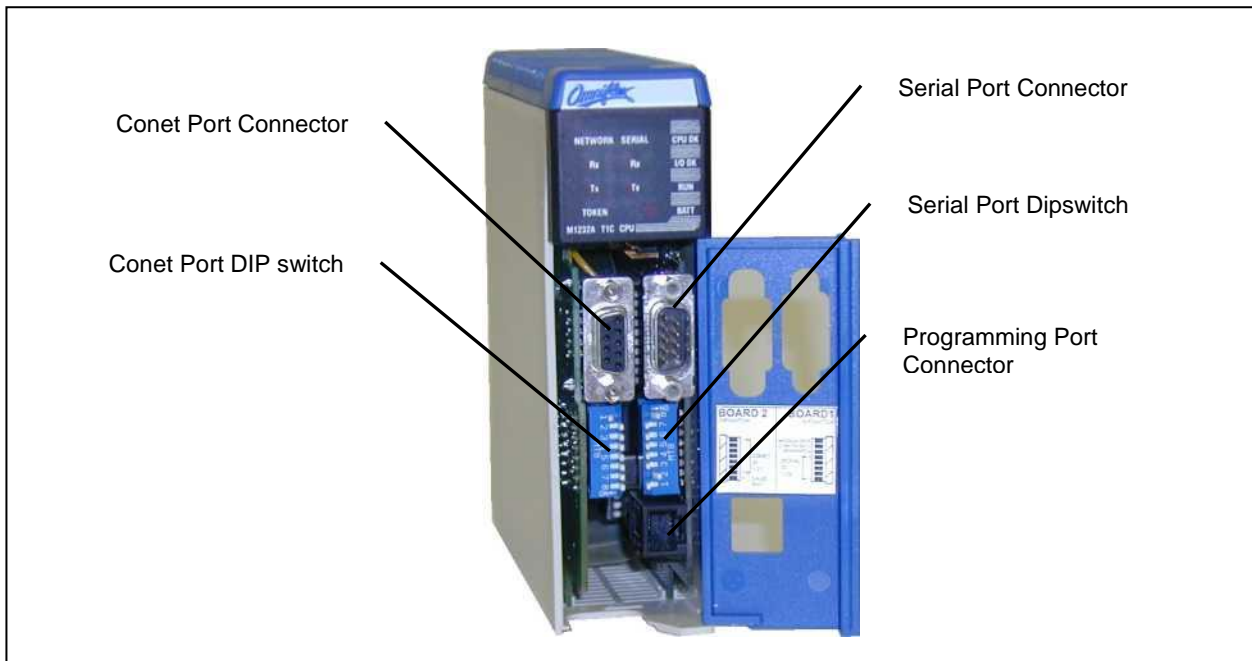*Setting Up a CPU via Omniset Pro*

EziForth Programmability

Every T2 CPU is equipped with the an EziForth programming engine, to allow many types of application program to be executed locally on the CPU. Examples include custom protocols, data storage, data conversion and control.

Module General Layout

Conet Port Connector

Conet Port DIP switch

Serial Port Connector

Serial Port Dipswitch

Programming Port Connector

Specifications

Communications Ports

Programming Port (on all models)

Type	Asynchronous RS232 serial port
Protocols	Supports Conet/s which allows remote programming and full system data access through the programming port.
Standard Baud Rate	Preset at 19,200 baud
Maximum cable length	5 meters
Connection	RJ11 jack. Use with Model M1831 2 metre long programming cable for connection to PC serial port (9 pin).

Serial Port (on all models)

Type	Asynchronous RS232/485 serial port
Protocols	Supports Conet/s and Modbus ASCII and RTU as standard, but other protocols may be downloaded to the CPU.
Baud Rate	300 – 19,200 baud.
Maximum cable length	5 meters (50ft) in RS232 mode 1200m (4000ft) in RS485 mode
Connection	9 pin sub-miniature DB9 (male).

CONET twisted pair network Port (On M1241 T2c model only)

Type	Token passing peer-to-peer industrial LAN.
Baud Rates	62.5 kBaud on Standard Baud Rate 7800 Baud on Slow Baud Rate.
Maximum cable length	10km
No of nodes on one network	126

CONET/e Ethernet Port (On M1242 T2e model only)

Type	10BaseT Interface (UTP via RJ45)
Network Protocol Support	TCP/IP, BOOTP, TFTP, ICMP, ARP, SNMPv2, MIB-II, Telnet
Protocols	Modbus Slave (using serial port redirector software) Modbus/TCP Class 0

CONET/m Radio network Port (On M1243 T2m model only)

Type	Four wire half-duplex 600 ohm audio interface.
Modulation	Minimum Shift Keying (MSK).
Signalling	E & M signalling
Baud Rate	1200 baud
No of nodes on one network	255
Digipeating	Up to six levels.
Distance	Depends on Radio System Power

Memory

User Program	10k Program Space in EEPROM
User Variables	6k Battery Backed RAM
Data Interchange Table	4750 16 bit Registers on CPU

	Up to 4000 Registers in each I/O Module.

Front Panel Indicators

CPU OK (Green)	On = CPU Healthy Flashing or Off = CPU faulty
I/O OK (Green)	On = I/O OK Flashing = I/O does not match configuration. Off = I/O configuration not set.
RUN (Green)	On = Application Program Running Off = No application program or application program not running Flashing = 2 second startup period in progress.
BATT (Red)	Off = Lithium Battery healthy On = Lithium Battery required replacing. (Battery used for real-time clock and User Data retention.)
Serial Tx (Red)	On = data is waiting to be sent out serial port. Off = no data waiting to be sent.
Serial Rx (Amber)	On = Data is being received on serial port. Off = No data being received.
Network Tx (Red)	Flashes for each CONET network data message received (to the correct address.)
Network Rx (Amber)	Flashes for each CONET network data message sent.
Network Token (Green) (T2c CPU Only)	Flashes at a rate proportional to the speed that the token is passed along the network.
Network Link (Green) (T2e CPU only)	On = Ethernet network link is good.
Network Fault Indication	All three Network LED's flash simultaneously if the Node Address is incorrectly set.

Real Time Clock

Resolution	10 milliseconds
Accuracy	1 minute per month
Battery Life	Greater than 1 year with power off. Greater than 5 years with power on.
Battery Type	3.6V Lithium wafer Cell Model TL-5186

Environmental

Operating Temperature	-25°C to +60°C (-13°F to +140°F)
Storage Temperature	-40°C to +70°C (-40°F to +158°F)
Humidity	95% max. at 40°C (104°F) non-condensing.
Protection	Electronics conformal coated

Logic Power Consumption

From Logic Power Supply	450mA from 5Vdc max.

Mass

Excluding Packaging	390g (13.8oz)
Including Packaging	480g (16.9oz)

Ordering Information

Model	Order Code
T2 CPU	M1240B
T2c CPU (with Conet twisted pair network Port)	M1241B
T2e CPU (with Conet/e Ethernet network Port)	M1242B
T2m CPU (with Conet/m radio network Port	M1243B