symphony™

Instruction
Harmony Series

Distributed Sequence of Events

ABB

Preface

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Electrical Shock Hazard During Maintenance
Disconnect power or take precautions to insure that contact with energized parts is avoided when servicing.

SPECIFIC WARNINGS

Never operate any SOE module with the machine fault timer circuit disabled. Damage to equipment and injury to personnel could occur. (p. 3-5, 3-7, 3-11)

Disconnect power before installing dipshunts on the MMU backplane. Failure to do so will result in contact with cabinet areas that could cause severe or fatal shock. (p. 3-5, 3-8, 3-12)

Never clean electrical parts or components with live power present. Doing so exposes you to an electrical shock hazard. (p. 6-3)

Wear eye protection whenever working with cleaning solvents. When removing solvents from printed circuit boards using compressed air, injury to the eyes could result from splashing solvent as it is removed from the printed circuit board. (p. 6-3)

There are exposed AC and DC connections inside the cabinet. These exposed electrical connections present a shock hazard that can cause injury or death. (p. 6-4)

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SPECIFIC CAUTIONS	Turn off cabinet power before doing any termination unit wiring. Failure to do so could result in equipment damage. Do not apply power until all wire connections have been verified. (p. B-5)

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Introduction

Section 1

Overview

The Distributed Sequence of Events (SOE) provides a fully integrated system approach to event monitoring, recording and reporting for the Symphony Enterprise Management and Control System. Digital input transitions are collected and time-stamped at the time of occurrence. All input detection modules are time-synchronized, and coordinated through an external time input (e.g., satellite receiver system (SRS)). This event input data is passed over the network to the INSOE01, Sequence of Events Server Node which is responsible for collecting and sorting event data coming from distributed Harmony control units (HCU). This stored event data is made available to the human system interface for report generation.

The SOE system is comprised of the following Harmony rack modules (Fig. 1-1):

- INSEM01 Sequence of Events Master.
- INTKM01 Time Keeper Master.
- INNIS01 Network Interface.
- IMSET01 Sequence of Events Timing.
- IMSED01 Sequence of Events Digital Input.

The IMSED01 and the IMSET01 modules are I/O modules capable of acquiring 16 digital inputs with one millisecond resolution. The IMSET01 module receives and decodes the time-sync link time information sent by the INTKM01 module. The NTKM01 module provides the time information to the INSEM01 module and to the time-sync link.

The NTST01 unit is a termination unit that interfaces the INTKM01 module and IMSET01 modules with the time-sync link system. The time-sync link allows the sync time information transmission from the INTKM01 module to all IMSET01 modules. The NTST01 unit permits the connection between the INTKM01 module and the receiver.

The INSEM01 module is a Cnet communication module that is responsible for collecting SOE data from the Harmony control unit nodes, detecting triggers and providing event data to the

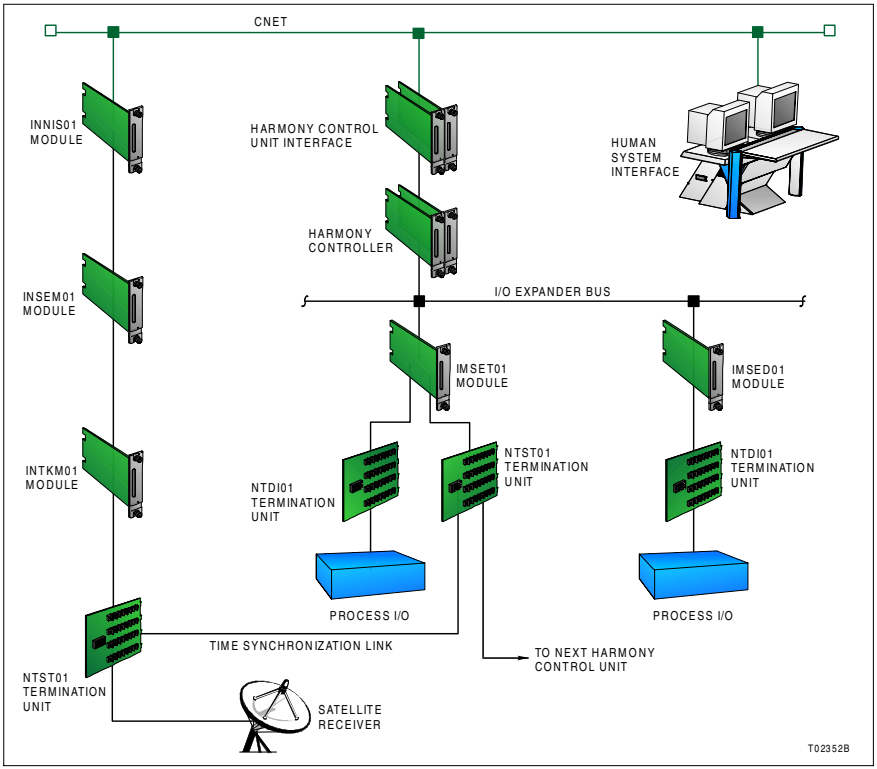

Figure 1-1. Harmony Rack SOE Architecture

human system interface for report presentation. The INNIS01 module is the front end for all Cnet communication. It is the intelligent link between a node and Cnet.

Intended User

Personnel installing, operating, or maintaining the SOE modules should read this instruction before performing any installation, operation, or maintenance procedures. Installation requires an engineer or technician with experience handling electronic circuitry. Those working with the SOE modules should have experience working with and know the

precautions to take around AC/DC power. A knowledge of the Symphony system and electronic principles is also required.

Instruction Content

This instruction consists of the following sections:

Introduction	Contains a brief overview, general usage information, and technical specifications.
Description and Operation	Uses block diagrams to explain module operation and input circuitry.
Installation	Covers the preliminary steps to install the modules and prepare for operation. It covers address switch settings, mounting, wiring connections, and cabling.
Operating Procedures	Provides information on front panel indicators and startup procedures.
Troubleshooting	Explains the meaning of error indications and contains troubleshooting procedures.
Maintenance	Contains scheduled maintenance tasks and procedures.
Repair and Replacement	Contains procedures that explain how to replace a module.

How to Use this Instruction

Read this instruction in sequence. It is important to become familiar with the entire contents of this instruction before using the modules. Refer to a specific section for information as needed.

1. Read the operating procedures section before installing the module.

2. Perform the steps in the installation section.

3. Refer to the troubleshooting section to resolve problems if they occur.

4. Refer to the maintenance section for scheduled maintenance requirements.

5. Refer to the repair and replacement procedures to replace a module.

Document Conventions

The ? in a nomenclature or a part number indicates a variable for that position (e.g., IMMFP1?).

Glossary of Terms and Abbreviations

Table 1-1 contains those terms and abbreviations that are unique to ABB Automation or have a definition that is different from standard industry usage.

Table 1-1. Glossary of Terms and Abbreviations

Term	Definition
Cnet	Symphony system advanced data communication highway.
Controlway	High speed, redundant, peer-to-peer communication link. Used to transfer information between intelligent modules within a Harmony control unit.
DEBFILT	Debounce filtering time. A constant identifying the minimum time of a sequence of events input must stay in a state, so that its transition can be considered valid.
Event	Sequence of events input transition which has to be considered relevant for sequence of events management.
Function code (FC)	An algorithm which manipulates specific functions. These functions are linked together to form the control strategy.
GPS	Global positioning satellite receiver.
I/O expander bus	Parallel communication bus between the Harmony rack controllers and rack I/O modules.
IRIG-B	Inter-range instrumental group interface for communications with time code unit.
Module mounting unit (MMU)	A card cage that provides electrical and communication support for Harmony rack modules.
SOE	Sequence of events.
Termination unit (TU)	Provides input/output connection between plant equipment and the Harmony rack modules.
Time-stamp	Time at which the event is estimated to have occurred; it is the detection time-stamp minus the event detection delay.

Reference Documents

Table 1-2 lists instructions for equipment that are referenced in this instruction.

Table 1-2. Reference Documents

Number	Document
WBPEEUI200502??	Module Mounting Unit (IEMMU11, IEMMU12, IEMMU21, IEMMU22)
WBPEEUI210502??	Modular Power System II
WBPEEUI210504??	Symphony Function Code Application Manual
WBPEEUI250017??	Cnet-to-HCU Communication Interface
WBPEEUI260042??	Digital Input Termination Unit (NTDI01)
WBPEEUI260048??	Communication Termination Unit (NTCL01)
WBPEEUI270003??	Composer, Automation Architect

Related Nomenclature

Table 1-3 lists nomenclature related to the distributed sequence of events system.

Table 1-3. Related Nomenclature

Nomenclature	Description
SRS	Satellite Receiver System
IMSED01	Sequence of Events Digital Input
IMSET01	Sequence of Events Timing
INNIS01	Network Interface Module
INSEM01	Sequence of Events Master
INSOE01	Server Node: INNIS01, INSEM01, and INTKM01
INTKM01	Time Keeper Master
NFTP01	Field Termination Panel
NKLS01-10	INNIS01 to NTCL01 Cable
NKSD01-10	IMSED01 to NTDI01 Cable
NKST01 -10	IMSET01 to NTDI01 and NTST01 Cable
NKTK01	INTKM01 to NTST01 Cable
NTCL01	Communication Link Termination Unit
NTDI01	Digital I/O Termination Unit

Table 1-3. Related Nomenclature *(continued)*

Nomenclature	Description
NTST01	Time-Sync Termination Unit
NTU-7I1	Isolated Digital Input Termination Unit

Specifications

Tables 1-4 through 1-9 contain SOE module specifications.

Table 1-4. INSEM01 Specifications

Property	Characteristic/Value
Power requirements Operating voltage Power dissipation	 +5 VDC, ±5% at 1.78 A typical 8.9 W typical
Microprocessor	16 bits running at 10 MHz
Memory SRAM NVRAM ROM	 2 Mbytes (total), 64 kbytes (available) 512 kbytes (total), 256 kbytes (available) 512 kbytes (total)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Table 1-5. INTKM01 Specifications

Property	Characteristic/Value
Power requirements Operating voltage	 +5 VDC, ±5% at 300 mA typical, 500 mA maximum
Microprocessor CPU Instruction cycle Timer Port	DSP 2101 16 bits running at 10 MHz 100 ns 16 bit interval timer with prescaler 1 bidirectional synchronous serial port
Memory Boot EPROM RAM FIFO Program memory RAM Data memory RAM	 64 kbyte 16 kword 512 byte 1 kword 512 word
Frequency	10 MHz
Stability	±1 ppm
Aging	1 ppm/year

Table 1-5. INTKM01 Specifications *(continued)*

Property	Characteristic/Value
Synchronization time	±10 µs
Absolute time (to INSEM01)	±1 ms
Input	IRIG-B time code in DC level shift format (through NTST01)
Output	RS-485 time synchronization at 62.6 kbaud to IMSET01 modules (through NTST01)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Table 1-6. IMSED01 Specifications

Property	Characteristic/Value
Power requirements Operating voltage	 +5 VDC, ±5% at 350 typical mA, 500 mA maximum
Digital inputs Voltage	 24 VDC (±10%) 48 VDC (±10%) 125 VDC (±10%) 120 VAC (±10%) (only for system control logic)
Current (typical)	5 mA at 24 VDC 4 mA at 48 VDC 4 mA at 125 VDC 5 mA at 120 VAC
Turn-on voltage (minimum)	21.6 V at 24 VDC 43.2 V at 48 VDC 112.5 V at 125 VDC 108 V at 120 VDC
Turn-off voltage (maximum)	10 V at 24 VDC 20 V at 48 VDC 50 V at 125 VDC 50 V at 120 VDC
Maximum input current at minimum turn-on	4 mA at 21.6 VDC 4.4 mA at 43.2 VDC 3.2 mA at 112.5 VDC 4 mA at 108 VDC
Maximum current off-state (for all DI voltages)	1.5 mA
Isolation	350 VDC/V_{RMS} channel to channel 1,000 VDC/V_{RMS} channel to system

Table 1-6. IMSED01 Specifications *(continued)*

Property	Characteristic/Value
Response time (typical)	DC fast 1.1 ms DC slow 18 ms AC 5 ms after the first positive half cycle
Surge protection	Meets IEEE-472-1974 surge withstand capability test
Microprocessor CPU Instruction cycle Timer Port	DSP 2101 16 bits running at 10 MHz 100 ns 16 bit interval timer with prescaler 1 bidirectional synchronous serial port
Memory Boot EPROM RAM FIFO Program memory RAM Data memory RAM	 64 kbyte 64 kbyte 512 byte 1 kword 512 word
Communication port IMSET01 (with NTST01)	RS-485

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Table 1-7. IMSET01 Specifications

Property	Characteristic/Value
Power requirements Operating voltage	 +5 VDC, ±5% at 350 mA typical, 500 mA maximum
Digital inputs Voltage Current (typical) Turn-on voltage (minimum) 	 24 VDC (±10%) 48 VDC (±10%) 125 VDC (±10%) 120 VAC (±10%) (only for system control logic) 5 mA at 24 VDC 4 mA at 48 VDC 4 mA at 125 VDC 5 mA at 120 VAC 21.6 V at 24 VDC 43.2 V at 48 VDC 112.5 V at 125 VDC 108 V at 120 VDC

Table 1-7. IMSET01 Specifications *(continued)*

Property	Characteristic/Value
Digital inputs *(continued)* Turn-off voltage (maximum) Maximum input current at minimum turn-on Maximum current off-state (for all DI voltages)	 10 V at 24 VDC 20 V at 48 VDC 50 V at 125 VDC 50 V at 120 VDC 4 mA at 21.6 VDC 4.4 mA at 43.2 VDC 3.2 mA at 112.5 VDC 4 mA at 108 VDC 1.5 mA
Isolation	350 VDC/V_{RMS} channel to channel 1,000 VDC/V_{RMS} channel to system
Response time (typical)	DC fast 1.1 ms DC slow 18 ms AC 5 ms after the first positive half cycle
Surge protection	Meets IEEE-472-1974 surge withstand capability test
Microprocessor CPU Instruction cycle Timer Port	DSP 2101 16 bits running at 10 MHz 100 ns 16 bit interval timer with prescaler 1 bidirectional synchronous serial port
Memory Boot EPROM RAM FIFO Program memory RAM Data memory RAM	 64 kbyte 64 kbyte 512 byte 1 kword 512 word
Communication port IMSET01 (with NTST01)	RS-485

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Table 1-8. NTST01 Specifications

Property	Characteristic/Value
Power requirements Operating voltage	 ±10% at +24 VDC typical 150 mA, 250 mA maximum
Wire size	22 AWG, 0.32 sq-mm (minimum) 12 AWG, 3.3 sq-mm (maximum)

Table 1-8. NTST01 Specifications *(continued)*

Property	Characteristic/Value
Voltage isolation between synchro link and IRIG-B input to system	1,000 VAC 50 Hz 2,000 V_p 1.2/50 µs pulse
TWINAX cable Maximum length between 2 HCU cabinets Maximum length between INSOE01 server node and the farthest HCU cabinet	 4,000 m (13,123 ft) 40,000 m (131,233 ft)
Output Output synchro link Input IMSET01 synchro link INTKM01 IRIG-B (in DC level shift mode) IMSET01/INTKM01 connection (P2)	 5 lines differential output ±5 V ± 56 mA max out current (each line) 1 differential input 95 W input impedance 1 0-5 V level 50 W termination (selectable by jumper) RS 485 standard
Synchro link cable: Type Impedance Capacitance Attenuation Maximum distance between two units	 RG22B/U TWINAX cable 95 Ω 52.5 pF 0.96 dB/100 m at 1 MHz 4,000 m (2.5 mi)
Isolation (as for IEC-255-5) Pulse voltage test (1.2/50 µs) VAC 50 Hz	 Common mode 2 kVp Common mode 1 kV_{RMS}
Mounting	Screw mounts on the field termination panel

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Table 1-9. Common Specifications

Property	Characteristic/Value
Environment	
Ambient temperature	0°C to 70°C (32°F to 158°F)
Relative humidity	5% to 95% up to 55°C (131°F) (noncondensing) 5% to 45% at 70°C (158°F) (noncondensing) Pollution degree: 1
Atmospheric pressure	Sea level to 3 km (1.86 mi)
Air quality	Noncorrosive
Mounting	Modules occupy one slot in a standard module mounting unit

Table 1-9. Common Specifications *(continued)*

Property	Characteristic/Value
Certification Canadian Standards Association (CSA)	Certified for use as process control equipment in an ordinary (nonhazardous) location
Factory Mutual (FM) (pending for INTKM01, IMSED01, and IMSET01)	Approval for the following categories: Nonincendive for: Class I Division 2, Groups A,B,C,D Class II, Division 2, Groups F,G
CE Mark declaration	This product, when installed in a Symphony cabinet, complies with the following directives and standards for CE marking
EMC96 Directive 89/336/EEC	EN50082-2 Generic Immunity Standard- Part 2: Industrial Environment EN50081-2 Generic Emission Standard- Part 2: Industrial Environment
Low Voltage Directive 73/23/EEC	EN61010-1 Safety Requirements For Electrical Equipment For Measurement, Control And Laboratory Use- Part 1: General Requirements
Cooling requirements	No cooling necessary when used in a standard module mounting unit and operates within stated environmental limits

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Description and Operation

Section 2

Introduction

The Distributed Sequence of Events (SOE) provides the operator with an ordered sequence of state change events associated with up to 1,500 digital inputs with one millisecond resolution.

Digital input transitions are collected and time-stamped by I/O modules (IMSED01 and IMSET01). Noise and false transitions are filtered. Then event data is acquired by the associated controller by means of two dedicated function codes (241 and 242) and made available to the INSEM01 module.

The INSEM01 module collects and sorts the data coming from different Harmony control units (HCU). The INSEM01 module also processes all event data and makes it available for display on a human system interface when a trigger condition is met.

The INTKM01 module manages sequence of event time. The INTKM01 module receives time information in IRIG-B format from an external satellite receiver and makes it available to the system through a dedicated time-synchronization link. The time-sync link connects the INTKM01 module and all the IMSET01 modules in the system. The connection to the time-sync link is achieved by a NTST01 unit.

INSEM01 Module

The INSEM01 module communicates directly with the INNIS01 module and the INTKM01 module over the I/O expander bus. The INSEM01 module manages the following events:

- 1,500 points coming from the SOE I/O modules in up to 1,000 Harmony control units.
- 256 complex triggers with 16 operands each.
- 3,000 simple triggers.

The INSEM01 module consists of one printed circuit board and occupies one mounting unit slot adjacent to its associated INNIS01 module and INTKM01 module.

Two captive latches on the INSEM01 faceplate secure the module in the mounting unit. The faceplate contains 17 LEDs and a stop/reset switch.

INSEM01 module is configured by means of function codes 243, 244, 245 and 246 for the SOE parameters. INSEM01 module monitors the HCU nodes for data on an exception report basis, collects and sorts data acquired and provides sequence of events data to the human interface system for report presentation on a detection of a trigger condition.

INTKM01 Module

The INTKM01 module sends its internal time information to the INSEM01 module via the I/O expander bus and through the time-sync link via the NTST01 unit. The INTKM01 module can be connected to an external receiver using the IRIG-B time code link. The INTKM01 module uses the time information sent by the receiver to initialize and correct its time information. ***INTKM01 Installation*** in Section 3 describes the configuration needed for the Truetime Satellite Receiver model SRS.

Functions

The INTKM01 module performs the following functions:

- Sends time information on the time-sync link every second.
- Makes available the time information in the absolute time format on the I/O expander bus for the INSEM01 module.
- Updates its internal clock and maintains its synchronization with the time information provided by the external receiver.

The time information is transmitted every second from INTKM01 module on the time-sync link at 62.5 kilohertz. The time information is composed of the time information and the synchro pulse. The time information contains the number of milliseconds elapsed since 0:00 March 1, 1980, and is relative to the rising edge of the synchro pulse.

The absolute time is written every millisecond from the INTKM01 module on its I/O expander bus internal output buffer (FIFO_out), in this way the absolute time is always available for the INSEM01 module.

The time information is received by the INTKM01 module from the NTST01 unit by an IRIG-B interface. The INTKM01 module cyclically updates and adjusts the internal time using this time information.

After power-on the internal time is initialized with the absolute time provided by the INSEM01 module and the time information from the receiver. The absolute time is used to calculate the current year because the time information from the receiver does not contain this information. If the receiver is not present or does not supply the time information, the internal time is initialized with the absolute time from the time-sync master.

Updating Internal Clock

After the initialization the internal time information is adjusted with the time information provided by the receiver. If the receiver is absent the internal time information is not adjusted, and the precision of the time information generated by the INTKM01 module depends on the drift of the internal quartz oscillator.

The internal accuracy is set high if the INTKM01 module is synchronized by the receiver and low if the INTKM01 module runs with its internal quartz oscillator. Every one second the time information is transmitted from the receiver and the INTKM01 module uses this information to control and correct its internal clock.

Accuracy

The resolution of time information sent on the time-sync link is ±10 microseconds. The resolution of time information to the INSEM01 module is ±1 millisecond.

Block Diagram

INTKM01 module operations are controlled by the processor (Fig. 2-1). The module contains devices for the management of I/O for the external receiver and the I/O expander bus (I/O expander bus control, IRIG-B interface) and of the auxiliary computer devices (boot EPROM, RAM, machine fault timer, FIFO_in and FIFO_out, and time information interface).

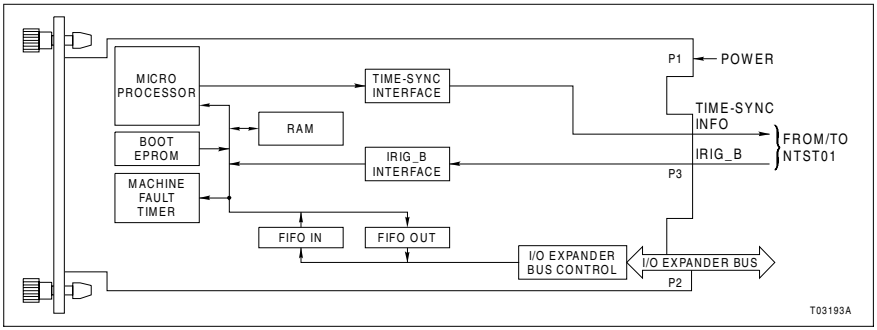


Figure 2-1. INTKM01 Block Diagram

Microprocessor

The INTKM01 module uses a DSP 2101, provided with internal memory for program and data storage, a timer and a bidirectional synchronous serial line. DSP 2101 uses an external BOOT EPROM containing the module firmware and an external RAM. In addition, the module contains the circuits for bus and address management.

BOOT EPROM — This memory is used upon power-on by the microprocessor to load its internal program memory. In addition, in the EPROM there is the configuration data pertinent to the logic circuitry of the board.

RAM — The RAM memory with 16 kiloword size is used for external code memory.

FIFO — These two FIFO memories are used to transfer data between the I/O expander bus master (INSEM01) and the internal microprocessor.

FIFO_in is used to transfer the absolute time from INSEM01 module to the INTKM01 module in the initialization sequence. FIFO_out is used to transfer the absolute time information from the microprocessor to the I/O expander bus master. The absolute time is written on FIFO_out every one millisecond. The size of each memory is 512 bytes.

IRIG-B Interface

These circuits allow the connection between the INTKM01 module and the signal coming from the external receiver through the NTST01 unit. The IRIG-B time codes are a group of rate-scaled serial time formats containing the time-of-year in binary coded decimal. This time information includes days, hours, minutes, seconds, tenths of seconds, and hundredths of seconds. The IRIG-B is transmitted every second and the INTKM01 module accepts it in the DC level shift format.

Sync Time Information Interface

This interface is used to generate the sync time information. It is transmitted every second to the NTST01 unit. The time information is generated by the serial port of the processor and a synchro pulse is generated by an internal synchro circuit.

The transmission of the sync time information to the NTST01 unit is performed in a RS-485 standard at 62.5 kilohertz. The NTST01 unit transmits to the INTKM01 module, through a RS-485 line. If the INTST01 unit is in a fault state or is not connected, the INTKM01 module detects the absence of its NTST01 unit.

I/O Expander Bus Control

These circuits include the control circuit for the accesses from I/O expander bus and the communication circuit and FIFOs between the microprocessor and I/O expander bus master (INSEM01). The circuits contain the module address set in the module address switch, and generate the control signals in the various types of access from I/O expander bus.

Machine Fault Timer

The microprocessor continually retriggers the machine fault timer. If the microprocessor or the firmware fails the controller goes in fail state. The INSEM01 module reads this state and stops the module operations.

IMSED01 and IMSET01 Modules

The IMSED01 and IMSET01 modules acquire 16 digital inputs from the field, and are connected by NTDI01 or NTU-7I1 termination units. They communicate through the I/O expander

bus with the controller for exchanging data and information for event synchronization. The IMSET01 module is also connected to the time-sync link by an NTST01 unit. One IMSET01 module and up to 63 IMSED01 modules can be supported by one controller.

Functions

The IMSET01 and IMSED01 modules perform two functions:

- The acquisition of the 16 digital inputs from the field.
- The synchronization of their internal clocks.

The IMSET01 module receives the time information from the time-sync link and keeps the internal clocks synchronized with this time. The two modules are controlled by the controller, and communicate across the I/O expander bus. The controller keeps the IMSED01 modules synchronized by reading the time from the IMSET01 module and writing it to the IMSED01 modules with a broadcast message.

Digital Inputs

The IMSET01 and IMSED01 modules can operate in two distinct modes: DI standard mode and sequence of events mode.

- In DI standard mode the 16 digital inputs are acquired by using dedicated function codes 241 and 242 which control the 16 digital inputs as a function code 84. In DI standard mode the digital inputs have a filter on each input channel. It is possible to select two response times by jumper: fast (1.5 milliseconds) and slow (18 milliseconds).
- In sequence of events mode all digital inputs are acquired every millisecond and compared to the previous value. If there is a change in one or more inputs, the new status is stored internally and placed in a FIFO_out buffer (Fig. 2-2), with its own time-stamp.

A debounce procedure and a delay procedure are processed during acquisition. The debounce procedure ensures the validity of an input state change. A configuration parameter (DBFILT, unique for the 16 DI channels) determines the duration for which an input reading must remain stable to be accepted as a state change. The delay procedure compensates for the delay time in switching from zero to one (T_on) or from

one to zero (T_off) for each channel. T_on and T_off are configuration parameters for each channel.

The delay is the estimated delay between the occurrence of the physical event and the time at which the event has been detected. It is estimated on the basis of characteristics of the acquisition equipment, it can be different for transition from zero to one and for transition from one to zero.

In addition, each digital input can be configured out of scan. A state change of an out of scan digital input is not placed in the FIFO_out.

Time-Synchronization

The sync time information is transmitted every second by the INTKM01 module on the time-sync link. The IMSET01 module receives the time information and uses it to update its internal clock.

IMSED01 Block Diagram

IMSED01 module operations are controlled by a microprocessor (Fig. 2-2). The module also contains devices for the management of I/O operations (I/O expander bus control, DI isolation, DI circuits), and microprocessor auxiliary devices (boot EPROM, RAM, machine fault timer, FIFO_in and FIFO_out).

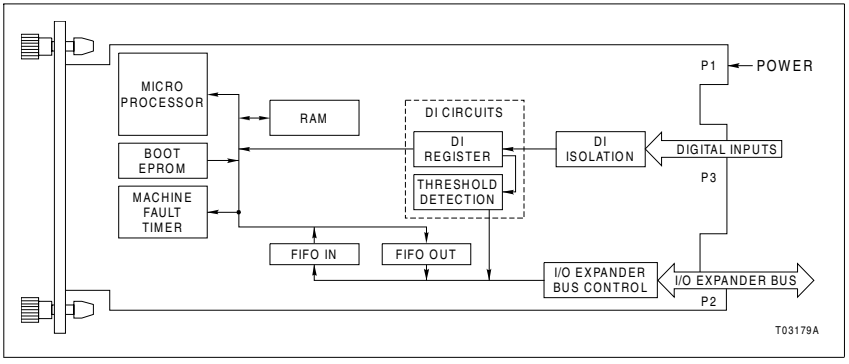


Figure 2-2. IMSED01 Block Diagram

Microprocessor

The IMSED01 module uses a DSP 2101, provided with an internal memory for program and data storage, a timer and a bidirectional synchronous serial line. DSP 2101 uses an external BOOT EPROM containing the module firmware and an additional external RAM. The module also contains bus and address management circuits.

BOOT EPROM — This memory is used at power up to load the module program into RAM.

RAM — The RAM memory is partitioned into two pages of 14 kilowords each. The RAM is used for its external code memory and the buffer containing the DI status changes.

FIFO — The two FIFO memories are used to transfer data between the controller and the internal microprocessor. FIFO_in is used by the controller to send the configuration parameters and the commands to the IMSED01 module. FIFO_out is used to transfer information relative to the digital input acquired in the sequence of events mode from the IMSED01 module to the controller. The size of each FIFO is 512 bytes.

Digital Input Isolation

These DI isolation circuits receive the state of the 16 digital input signals through the P3 connector. The supply voltages of the digital inputs are +24 VDC, +48 VDC, +125 VDC, 120 VAC and they must be supplied in the field or by the termination unit. The 120 VAC supply voltage can be used only for the DI standard mode. The setting of the input voltage is implemented on each channel by means of jumpers. Each channel contains an overvoltage protection circuit and an optocoupler which ensures that the card is totally isolated from the field.

Digital Input Circuits

After the isolators the digital inputs are sent to two distinct circuits. The first, known as threshold detection and hysteresis, is used for DI standard mode. The second, known as digital input register, is used for acquisition in sequence of events mode.

The digital inputs in DI standard mode have a filter on each input channel. The filter, carried out with RC and a threshold

comparator, make it possible to obtain two response times, selectable by a jumper: fast (1.5 milliseconds) and slow (18 milliseconds). The filtered digital inputs are sent to the I/O expander bus.

In the sequence event mode, downstream the optocoupler, in addition to being issued to the filters, the digital inputs are sent to digital input registers, from which they are read by the microprocessor.

The states of the digital inputs are displayed by 16 LEDs on the front panel of the module.

I/O Expander Bus Control

These circuits include the control circuit for the accesses from I/O expander bus and the communication circuit and FIFOs between the processor and a controller. The circuits contain the module address (set in the module address switch), and generate the control signals in the various types of access from I/O expander bus.

Machine Fault Timer

The microprocessor continually retriggers the machine fault timer (MFT). If the microprocessor or the firmware fails, the controller goes in fail state. The controller reads this state and stops module operation.

IMSET01 Block Diagram

The IMSET01 module has the same block diagram of the IMSED01 module, with the addition of the time-sync input to the microprocessor block (Fig. 2-3).

Time-Sync Input

The IMSET01 module receives the time-sync link time information from the NTST01 unit transmitted via the RS-485 standard. The time-sync input circuits convert the received signals and send them to the RX serial port of the microprocessor. If the NTST01 unit is in fault state or is not connected, the IMSET01 module detects the absence of the NTST01 unit.

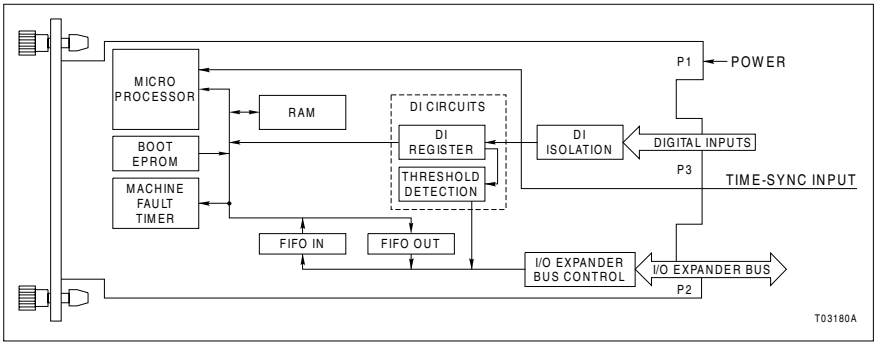


Figure 2-3. IMSET01 Block Diagram

NTST01 Termination Unit

The NTST01 termination unit attaches to a field termination panel with two screws and spacers. Figure 2-4 is the NTST01 block diagram. It is a printed board circuit that consists of:

- Input circuits.
- Output circuits.
- Optical isolators.
- INTKM01/IMSET01 interface.
- Voltage regulators (DC-to-DC converters).
- Bypass circuits.

The input circuits permit the time information reception, when the NTST01 unit is connected to the IMSET01 module. In the INTKM01 connection, these circuits receive the time information coming from the receiver in IRIG-B time code format. In both cases the time information received is sent to the modules connected through the INTKM01/IMSET01 interface.

The output circuits are composed of line drivers used to transmit the time information on the time-sync link.

In the INTKM01 connection, the time information comes from the INTKM01 module through the INTKM01/IMSET01 interface.

In the IMSET01 connection the time information comes from the input circuits. The time information is sent to the P1 connector using the RS-485 standard. The optical isolators

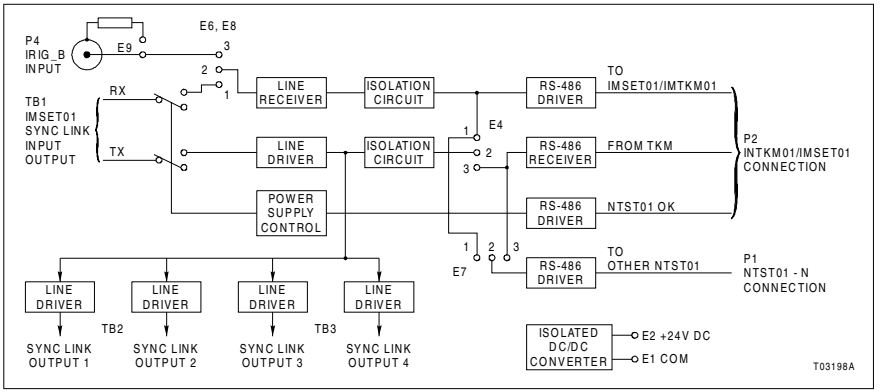


Figure 2-4. NTST01 Block Diagram

provide isolation between the input circuits, the INTKM01/IMSET01 interface, and the output circuits.

The communication between the NTST01 unit and the INTKM01 and IMSET01 modules is accomplished by RS-485 standard lines, through the connector P2 on the INTKM01/IMSET01 interface which converts the internal signals into the RS-485 standard.

The voltage regulators and DC-to-DC converters generate the 24 VDC, all the output voltages to supply the input circuits, the INTKM01/IMSET01 interface, and the output circuits. All voltages generated by the block are controlled by the power supply control that puts the NTST01 unit in bypass if one of the voltages is absent.

The bypass circuits operate when the NTST01 unit is connected to the IMSET01 module. They permit the connection of the input lines to the output lines present on terminal block TB1. The NTST01 unit is in bypass, when there is no power or the power supply control has detected a fault condition.

The NTST01 unit provides an automatic bypass device operating in case of fault as a protection-device against: voltage overflow, voltage inversion, temporary short circuit in the transmission circuits, and overvoltage in the transmission and receiving circuits. The output circuits are isolated from the input circuits.

Time-Synchronization Link

The sequence of events time-sync link provides the time synchronization for the system allowing the transmission of dedicated time information sent from INTKM01 modules to the IMSET01 modules connected to the time-sync link. The connection between the modules and the time-sync link is carried out by the NTST01 termination unit.

The time-sync link can have three different layout schemes:

- Sequential mode - This scheme provides the bypass of a faulty NTST01 unit allowing the forwarding of the time information to the next module (Fig. 2-5).
- Star mode - In this scheme a faulty NTST01 unit breaks the transmission of the time information to all downstream nodes (Fig. 2-6).
- Mixed mode - A combination of sequential and star mode (Fig. 2-7).

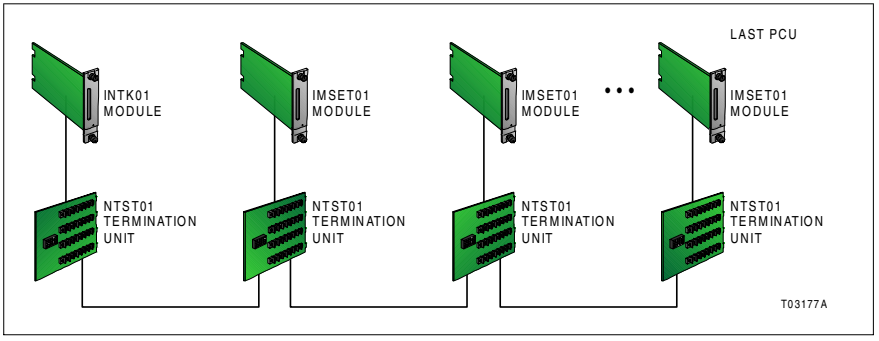


Figure 2-5. Sequential Time-Sync Link Connection

Mounting Hardware

The SOE modules and termination units mount in standard enclosures (CAB-01, CAB-04, CAB-12). The number of modules that can be mounted in a single cabinet varies.

An IEMMU11, IEMMU12, IEMMU21, or IEMMU22 Module Mounting Unit and an NFTP01 Field Termination Panel (FTP)

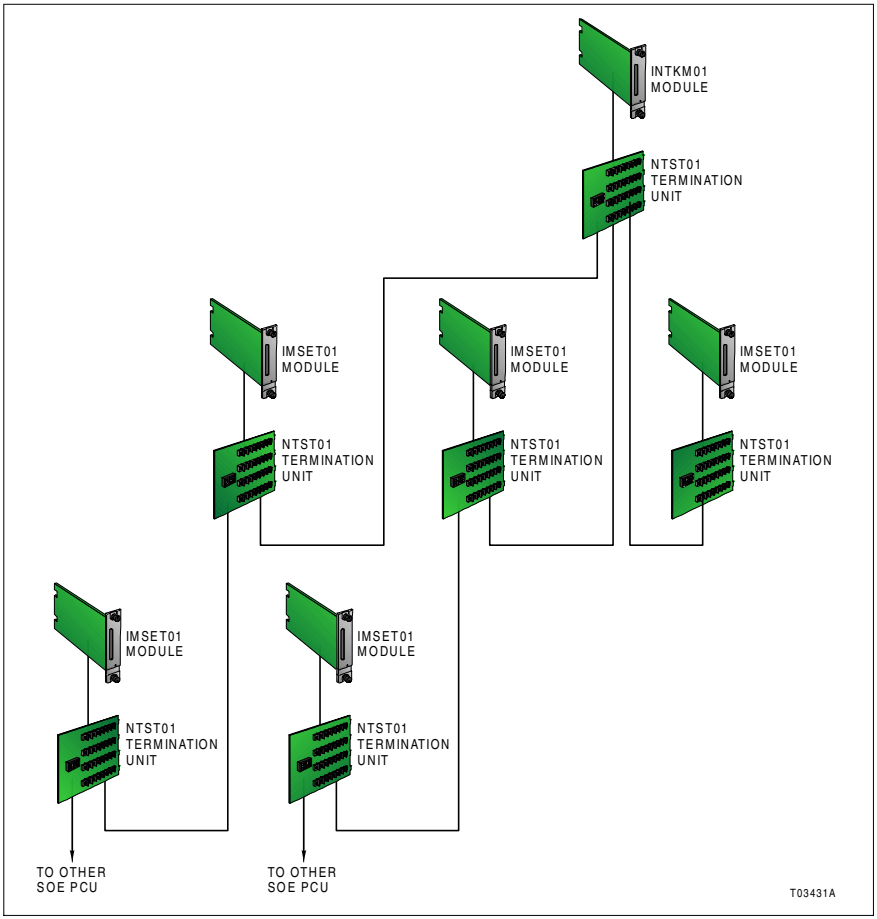


Figure 2-6. Star Time-Sync Link Connection

are used for module and termination unit mounting respectively (Fig. 2-8). The mounting unit and termination panel both attach to the side rails in standard 483-millimeter (19-inch) enclosures. Front mount and rear mount module mounting unit versions are available to provide flexibility in enclosure mounting.

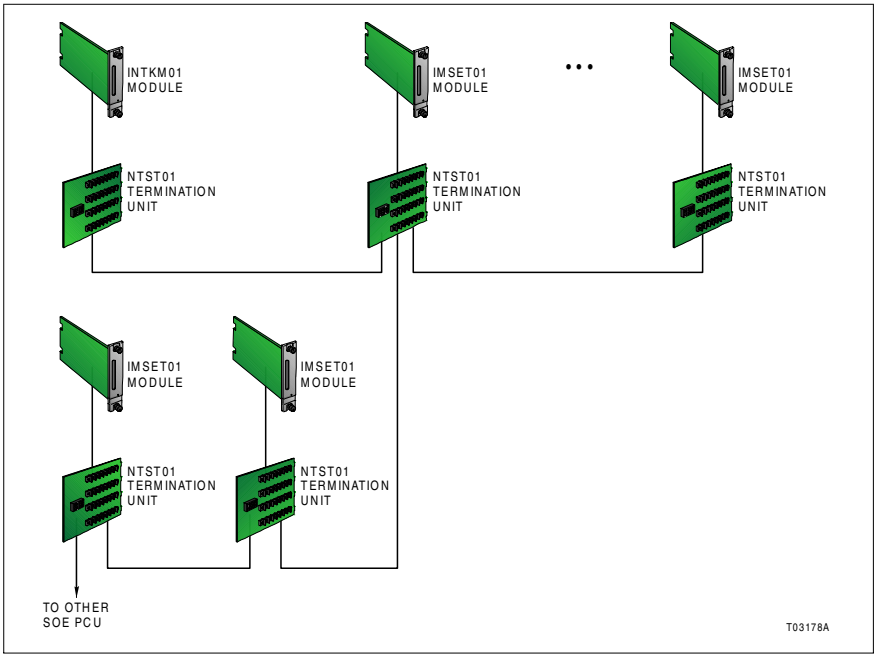


Figure 2-7. Mixed Time-Sync Link Connection

A module mounting unit is required to mount and provide power to rack-mounted modules. The unit is for mounting controllers, I/O modules, and communication interface modules. The module mounting unit backplane connects and routes:

- Controlway.
- I/O expander bus.
- Logic power to control, I/O, and interface modules.

The Controlway and I/O expander bus are internal cabinet, communication buses. Communication between rack controllers and communication interface modules is over the Controlway.

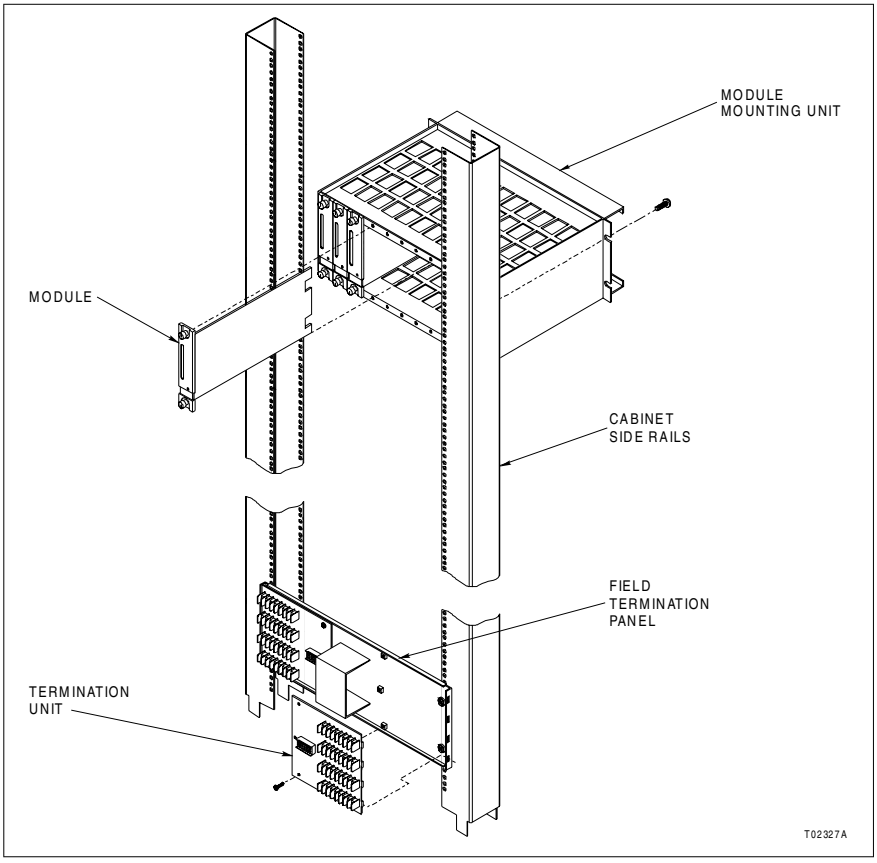


Figure 2-8. Mounting Hardware

Installation

Section 3

Introduction

This section explains the procedures required to place the SOE modules into operation. It includes instructions on setting the address selection switch, setup and physical installation, wiring and cable connections. ***Do not*** proceed with operation until this is read, understood and all steps have been completed.

Special Handling

NOTE: Always use the ABB Automation field static kit (part number 1948385A1), consisting of two wrist straps, ground cord assembly, alligator clip, and static dissipating work surface when working with static sensitive devices. The kit is designed to connect the technician and the static dissipating work surface to the same ground point to prevent damage to the static sensitive devices by electrostatic discharge.

Use the static grounding wrist strap when installing and removing modules. Static discharge may damage static sensitive devices on modules in a cabinet. Use grounded equipment and static safe practices when working with static sensitive devices.

1. ***Use Static Shielding Bag.*** Keep the module in its static shielding bag until you are ready to install it in the system. Save the bag for future use.

2. ***Ground Bags before Opening.*** Before opening a bag containing an assembly with static sensitive devices, touch it to the equipment housing or ground to equalize charges.

3. ***Avoid Touching Circuitry.*** Handle assemblies by the edges; avoid touching the circuitry.

4. ***Avoid Partial Connection of Static Sensitive Devices.*** Verify that all devices connected to the modules are properly grounded before using them.

5. ***Ground Test Equipment.***

6. ***Use an Antistatic Field Service Vacuum.*** Remove dust from the cards if necessary.

7. ***Use a Grounded Wrist Strap.*** Connect the wrist strap to the appropriate grounding plug.

8. ***Do Not Use Lead Pencils to Set Dipswitches.*** To avoid contamination of switch contacts that can result in unnecessary circuit board malfunction, do not use a lead pencil to set a dipswitch.

Unpacking and Inspection

1. Examine the hardware immediately to verify it has not been damaged in transit.

2. Notify the nearest ABB sales office of any such damage.

3. File a claim for any damage with the transportation company that handled the shipment.

4. Use the original packing material and container to store the hardware.

5. Store the hardware in an environment of good air quality, free from temperature and moisture extremes.

INSEM01 Installation

Install one INSEM01 module and one INNIS01 module to make a sequence of event server node. Refer to the ***Cnet-to-HCU Communication Interface*** instruction for INNIS01 module setting and installation.

1. Set the INSEM01 switches.

2. Verify dipshunts on the I/O expander bus are installed.

3. Install the module.

The INSEM01 module has four dipswitches. These switches select module operation options, serial port communication characteristics and baud rate. Figure 3-1 shows the component locations.

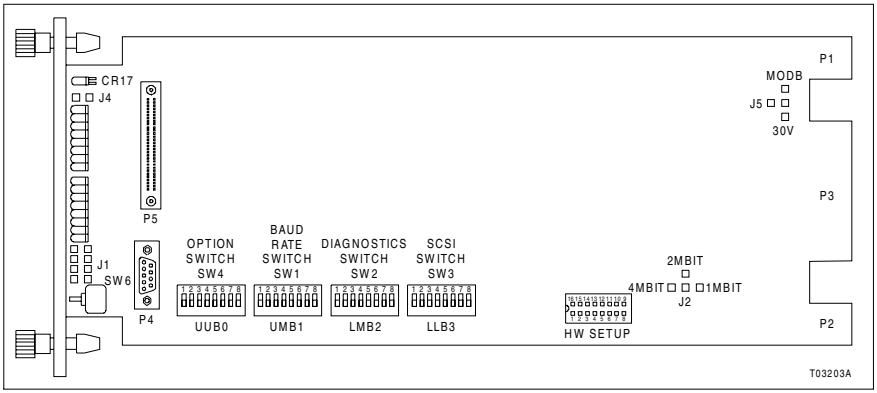


Figure 3-1. INSEM01 Module Layout

Special Operations Switch (SW1)

SW1 provides no meaningful settings for normal INSEM01 module operation. When the INSEM01 module performs special operations, SW1 is used in conjunction with SW4; refer to Figure 3-1 for SW1 switch and jumper locations.

Table 3-1. INSEM01 SW1 Special Operations

Pole 1 2 3 4 5 6 7 8	Special Operations	Description
0 0 0 0 0 0 0 0	0	Force module to configure mode.
0 0 0 0 0 0 1 0	2	Initialize NVRAM configuration space.

Diagnostics Switch (SW2)

Dipswitch SW2 enables interface diagnostics that are meaningful to qualified ABB service personnel only. All switch positions on SW2 must be closed for normal operation. Table 3-2 shows the possible switch settings. Verify that all switch positions on dipswitch SW2 are set to zero (closed or on).

Table 3-2. INSEM01 SW2 Diagnostics

Position	Settings	Function
1	0 1	NIS handshake time-out enabled NIS handshake time-out disabled
2	0 1	NIS diagnostic disabled NIS diagnostic enabled
3	0 1	Cnet diagnostic utilities disabled Cnet diagnostic utilities enabled
4	0 1	Hardware diagnostics disabled Hardware diagnostics enabled
5 - 7	N/A	Not used

NOTE: 0 = closed (on), 1 = open (off)

SCSI Port Switch (SW3)

The SW3 switch must be set to SCSI disabled. Refer to Table 3-3.

Table 3-3. INSEM01 SW3 SCSI Port

Position	Settings	Function
1	0	SCSI port disabled
2 - 8	1	Not used

NOTE: 0 = closed (on), 1 = open (off)

Option Switch (SW4)

SW4 is an eight position dipswitch that determines the operating options of the module. Table 3-4 lists the possible option settings.

Table 3-4. INSEM01 SW4 Options

Position	Settings	Function
1	0 1	ROM check summing enabled ROM check summing disabled
2 - 7	0	Not used
8	0 1	Normal operation Enable special operation

NOTE: 0 = closed (on), 1 = open (off)

Jumpers (J1, J2, J4 and J5)

WARNING	**Never operate any SOE module with the machine fault timer circuit disabled. Damage to equipment and injury to personnel could occur.**

There are four jumpers on the INSEM01 module. These jumpers are for special INSEM01 module hardware applications. They define the type of SRAM contained on the modules, enable the machine fault timer and enable the module to operate in a module mounting unit that uses -30 VDC. Jumpers J1 through J4 are factory set and should only be changed by qualified ABB service personnel.

Module Installation

NOTE: This installation section provides instructions pertaining to the physical installation of the SOE modules only. For complete cable and termination information, refer to the applicable termination unit instruction.

The IMSEM01 module inserts into a standard module mounting unit and occupies one slot. To install:

1. Verify the slot assignment of the module.

WARNING	**Disconnect power before installing dipshunts on the MMU backplane. Failure to do so will result in contact with cabinet areas that could cause severe or fatal shock.**

2. Verify that a dipshunt is in the I/O expander bus socket on the module mounting unit backplane between the INSEM01 module and the INNIS01 module, and between the INSEM01 module and the INTKM01 module.

3. Align the module with the guide rails in the module mounting unit. Gently slide the module in until the front panel is flush with the top and bottom of the module mounting unit frame.

Push and turn the two captive retaining screws on the module faceplate one half turn to the latched position. It is latched when the slots on the screws are vertical and the open ends face the center of the module.

INTKM01 Installation

This part of the section explains INTKM01 module setup and installation.

1. Set the INTKM01 module address switch (S1).

2. Set the jumpers on the module.

3. Verify dipshunts on the module mounting unit I/O expander bus and on the NTST01 unit are installed.

4. Connect cables.

5. Install the module.

Figure 3-2 shows the switch and jumper locations.

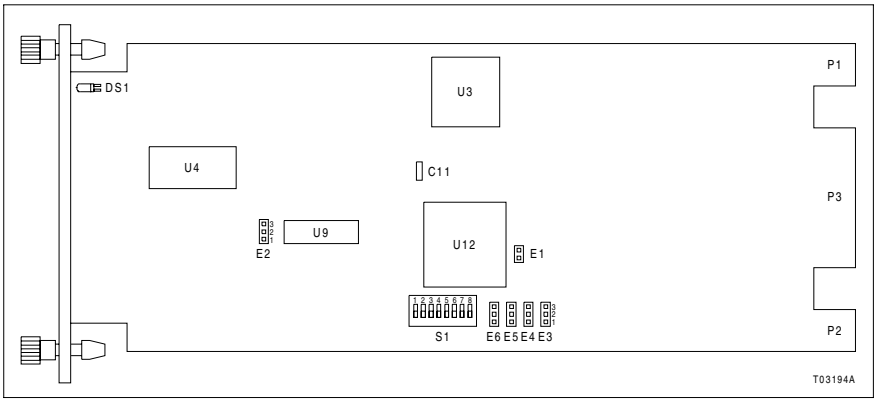


Figure 3-2. INTKM01 Module Layout

Address Switch (S1)

The INTKM01 module must have an address to communicate with the INSEM01 module. On the sequence of event server node the INTKM01 module address must be set to eight (Table 3-5).

Table 3-5. INTKM01 S1 Address Switch

ADDR	MSB							LSB
	1	2	3	4	5	6	7	8
8	0	0	0	0	1	0	0	0

NOTE: 0 = closed, 1 = open

Jumpers (E1 through E6)

Jumpers E1 through E6 are used to select the internal operation mode and the receiver type interface.

WARNING **Never operate any SOE module with the machine fault timer circuit disabled. Damage to equipment and injury to personnel could occur.**

The E1 jumper is for ABB Automation development personnel only. It is factory set, ***do not*** change this jumper setting. The E1 jumper is used to disable the machine fault timer circuit. If that function is disabled and a problem arises on the module, the module could generate wrong data on the I/O expander bus master and on the time-sync link.

The E2 jumper is used to change the operating mode of the module (Table 3-6). The module can operate both in normal and in diagnostic mode. If jumper E2 is set in the diagnostic mode, the microprocessor executes a self-diagnostic program to check the status of the various module devices. The test progress and result are displayed by a two-color status LED.

Table 3-6. INTKM01 E2 Jumper

Position	Function
1 - 2	Diagnostic mode
2 - 3	Normal mode

The test result is positive if the LED executes red-green-red flashing. Should this not occur, the diagnostic program has detected one or several operating errors. In this case the failed module must be replaced.

The jumpers E3 through E6 are used to select the receiver type interface (Table 3-7).

Table 3-7. INTKM01 E3 through E6 Jumpers

Jumper Position				Receiver Connection
E3	E4	E5	E6	
1-2	1-2	1-2	1-2	Receiver disconnected
2-3	1-2	1-2	1-2	Receiver connected to the INTKM01 module with IRIG_B interface

Module Installation

NOTE: This installation section provides instructions pertaining to the physical installation of the SOE modules only. For complete cable and termination information, refer to the applicable termination unit instruction.

The INTKM01 module inserts into a standard module mounting unit and occupies one slot. To install:

1. Verify the slot assignment of the module.

WARNING **Disconnect power before installing dipshunts on the MMU backplane. Failure to do so will result in contact with cabinet areas that could cause severe or fatal shock.**

2. Verify that a dipshunt is in the I/O expander bus socket on the module mounting unit backplane between the INTKM01 module and INSEM01 module. Remove any dipshunts that would connect the INTKM01 module to any other module except the INSEM01 module.

3. Connect the hooded end of the NTK01 termination cable from the NTST01 termination unit to the module mounting unit backplane. To do this, insert the connector into the backplane slot in the same slot as the one assigned to the digital output module. The latches should snap securely into place.

4. Align the module with the guide rails in the module mounting unit; gently slide the module in until the front panel is flush with the top and bottom of the module mounting unit frame.

5. Push and turn the two captive retaining screws on the module faceplate one half turn to the latched position. It is latched when the slots on the screws are vertical and the open ends face the center of the module.

Installing the module in a module mounting unit connects the card edge connector P1 to logic power necessary to operate the logic circuitry, and the card edge connector P2 to the expander bus. The card edge connector P3 is used to receive the IRIG-B and to transmit the sync time information through the NTST01 unit.

IMSED01 and IMSET01 Installation

This part of the instruction contains the procedures to set switches and jumpers, and install the IMSED01 and IMSET01 modules.

1. Set the IMSED01/IMSET01 module address (S1).

2. Set the jumpers on the modules.

3. Verify the dipshunts in the module mounting unit I/O expander bus and on the NTDI01 or NTU7I1 for the IMSED01 and IMSET01 modules and NTST01 termination unit for the IMSET01 module.

4. Connect cables.

5. Install the module.

Figure 3-3 shows the IMSED01 and IMSET01 modules switch and jumper locations.

Address Switch (S1)

The IMSED01 and IMSET01 modules must have an address to communicate with the controller. The modules can have one of 64 addresses (address 0 to 63) on the I/O expander bus. This address identifies the I/O module to the controller and must be the same as the address set in the controller setup data (function code 241 or 242, specification one).

Set the address with the eight position address dipswitch (S1) shown in Figure 3-3. The six left switch positions (one through six) of S1 set the six-bit address. Position seven and eight must remain in the closed position. Table 3-8 shows examples of binary address settings for S1.

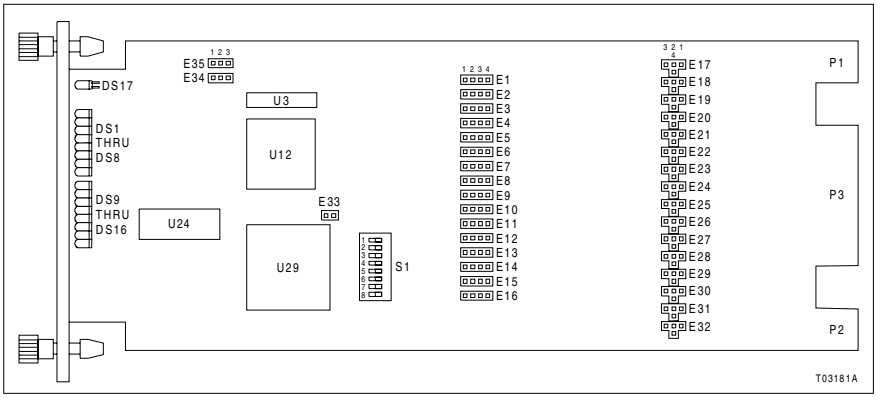


Figure 3-3. IMSET01 and IMSED01 Module Layout

Table 3-8. S1 Address Switch Settings Examples

ADDR	MSB					LSB
	3	4	5	6	7	8
5	0	0	0	1	0	1
15	0	0	1	1	1	1
32	1	0	0	0	0	0

NOTE: 0 = closed, 1 = open

Jumpers (E1 to E16 and E17 to E32)

Jumpers E1 through E16 are used to select the type of filter to be inserted into a digital input channel: fast (1.5 milliseconds) or slow (18 milliseconds). Jumpers E17 through E32 are used to select the supply voltage of a digital input channel. Table 3-9 shows the correspondence between digital input channels and jumpers. Table 3-10 shows the correspondence between filter type, supply voltage and jumper positions.

Table 3-9. IMSET01 and IMSED01 Digital Input Jumpers

Channel	Filter Jumpers	Voltage Jumpers
01	E1	E17
02	E2	E18
03	E3	E19

Table 3-9. IMSET01 and IMSED01 Digital Input Jumpers *(continued)*

Channel	Filter Jumpers	Voltage Jumpers
04	E4	E20
05	E5	E21
06	E6	E22
07	E7	E23
08	E8	E24
09	E9	E25
10	E10	E26
11	E11	E27
12	E12	E28
13	E13	E29
14	E14	E30
15	E15	E31
16	E16	E32

Table 3-10. IMSET01 and IMSED01 Jumper Selections (E1 through E32)

Voltage	E1-E16	E17-E32
120 VAC	1-2	1-2
125 VDC slow	2-3	open (not inserted)
125 VDC fast	3-4	open (not inserted)
48 VDC slow	2-3	2-4
48 VDC fast	3-4	2-4
24 VDC slow	2-3	2-3
24 VDC fast	3-4	2-3

NOTE: DI voltage of 120 VAC is permitted only in standard mode, do not use in sequence of event mode.

Jumpers (E33 to E35)

WARNING **Never operate any SOE module with the machine fault timer circuit disabled. Damage to equipment and injury to personnel could occur.**

The E33 and E34 jumpers are for ABB Automation development personnel only. They are factory set, ***do not*** change these jumper settings. The E33 jumper is used to disable the

machine fault timer circuit. If that function is disabled and a problem arises on the module, the module could generate wrong data to the controller. The E34 jumper is used to set module operation to IMSED01 or IMSET01 module (Table 3-11).

Table 3-11. Jumper E34 Positions

Position	Function
1 - 2	IMSET01 module
2 - 3	IMSED01 module

Table 3-12. Jumper E35 Positions

Position	Function
1 - 2	Diagnostic mode
2 - 3	Normal mode

The E35 jumper is used to change the module operating mode (Table 3-12). The module can operate either in normal mode or in diagnostic mode. If the E35 jumper is set in the diagnostic mode, the microprocessor runs a self-diagnostic program to check the status of the various module devices. Test running and result are displayed by a two-color LED.

The test result is positive if the LED executes the red and green flashing. Should this not occur, it means that the diagnostic program has detected one or more operating errors. In this case the failed module must be replaced.

Module Installation

NOTE: This installation section provides instructions pertaining to the physical installation of the SOE modules only. For complete cable and termination information, refer to the applicable termination unit instruction.

The IMSED01 or IMSED01modules insert into a standard module mounting unit and occupies one slot. To install:

1. Verify the slot assignment of the module.

WARNING	**Disconnect power before installing dipshunts on the MMU backplane. Failure to do so will result in contact with cabinet areas that could cause severe or fatal shock.**

2. Verify that a dipshunt is in the I/O expander bus socket on the module mounting unit backplane between the I/O module and controller.

3. Connect the hooded end of the termination cable (NKSD01 for IMSED01 module and NKST01 for IMSET01 module) from the termination unit to the module mounting unit backplane. To do this, insert the connector into the backplane slot in the same slot as the one assigned to the digital output module. The latches should snap securely into place.

4. Align the module with the guide rails in the module mounting unit. Gently slide the module in until the front panel is flush with the top and bottom of the module mounting unit frame.

5. Push and turn the two captive retaining screws on the module faceplate one half turn to the latched position. It is latched when the slots on the screws are vertical and the open ends face the center of the module.

Installing the module in a module mounting unit connects the card edge connector P1 to logic power necessary to operate the logic circuitry, and the card edge connector P2 to the expander bus. The card edge connector P3 is used to receive the IRIG-B and to transmit the sync time information through the NTST01 unit.

Installing the module in the module mounting unit connects the card edge connector P1 to logic power necessary to operate the logic circuitry, and the card edge connector P2 to the slave expander bus. The card edge connector P3 is used to acquire the 16 digital inputs from NTDI01 unit or NTU-7I1 unit, and the time signal from NTST01 unit for the IMSET01 module.

Cable Connections

Figure 3-4 shows cable connections and terminations related to IMSED01 and IMSET01 modules.

Termination Unit

Refer to Appendix B for the NTST01 termination unit configuration. Refer to Appendix C for the NTU-7I1 termination unit configuration.

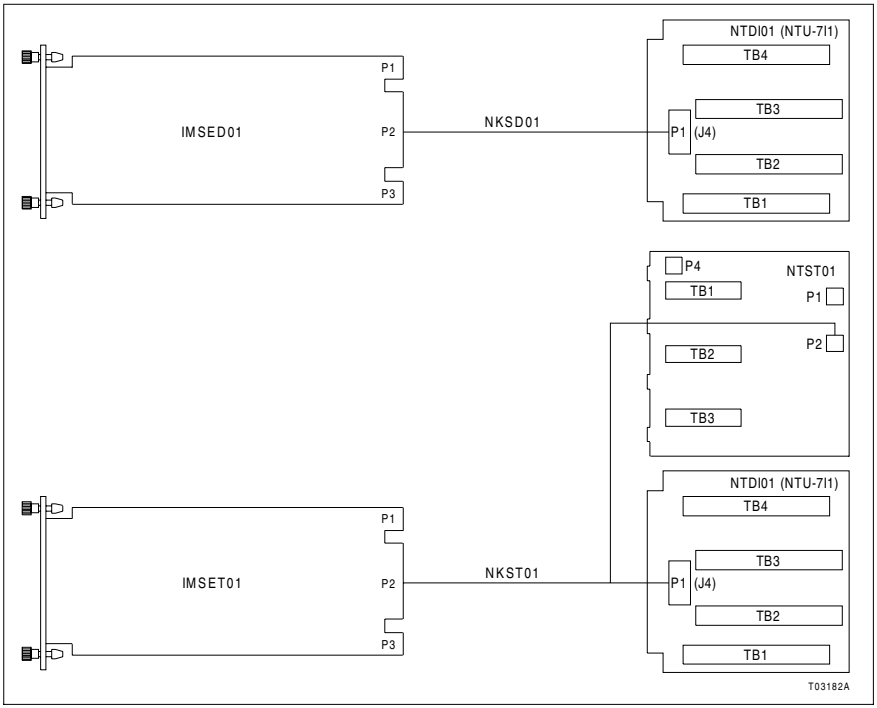


Figure 3-4. IMSED01 and IMSET01 Cable Connections

Operating Procedures

Section 4

Introduction

This section explains the front panel indicators, modes of operation and startup procedures for the SOE modules. The INSEM01, INTKM01, IMSED01, and IMSET01 modules have front panel status LED indicators to aid in system test and diagnosis. The controller controls the startup of the SOE modules. It is fully automatic.

INSEM01 Module

The faceplate of the INSEM01 module has the following components as shown in Figure 4-1:

- Status LED.
- 16 LEDs.
- Stop/reset pushbutton.

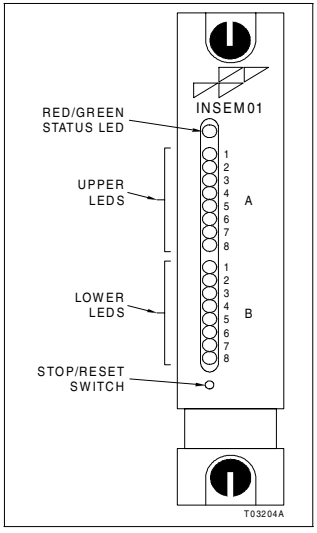


Figure 4-1. INSEM01 Front Panel

Status LED

The status LED is a red/green LED that displays the operating status of the INSEM01 module. It has three possible states. Table 4-1 lists the status of the LED states. Refer to the ***INSEM01 Module*** in Section 5 for corrective action if the status LED indicates that an operating error exists.

Table 4-1. INSEM01 LED States

LED State	Meaning
Off	No power.
Solid green	Execute mode.
Solid red	Diagnostics detected a hardware failure or configuration problem. The LEDs display an error code when the status LED is red.

There are two groups of eight LEDs. Group A LEDs display a moving pattern to indicate the module is functioning. Group B LEDs will display an error code and the status LED turns red if error occurs. Refer to Table 5-1 for a list of LED error codes and corrective actions.

Stop/Reset Pushbutton

Push the stop/reset pushbutton once and wait for the status LED to turn red before removing an INSEM01 module from the module mounting unit. Pressing the stop/reset pushbutton twice causes:

- Restoration of INSEM01 module to power up values after halt.
- Recovery from an operator-initiated stop or a module time-out.

Modes of Operation

The INSEM01 module has two modes of operation: execute and configure.

Execute

The execute mode is the normal mode of operation. In the execute mode, the module processes incoming exception reports

and general messages from the controller and produces exception reports and other messages to the human system interface. It reads INTKM01 module information time and status via the I/O expander bus. Data processing for sequence of events is performed.

Configure

This mode is used to enter SOE specifications and trigger definition. The INSEM01 module receives configuration commands over Cnet and changes data stored in NVRAM.

Security Functions

The INSEM01 module performs both hardware and software security checks to insure module integrity.

Hardware Checks

The INSEM01 module performs the following hardware checks:

- Illegal address detection - Detecting an illegal address generates a bus error and the INSEM01 module halts operation.
- Machine fault timer - The microprocessor updates this timer. A machine fault timeout halts module operation.

Software Checks

The INSEM01 module performs the following software checks:

- Module diagnostics - Module diagnostics execute automatically on system powerup. INSEM01 module faceplate LEDs display error conditions if the diagnostic test fail, the INSEM01 module status LED goes red and the module halts.
- ROM checksum check - This test verifies checksum of the ROM. Discrepancies cause the INSEM01 module status LED to go solid red and module operation halts.

INTKM01 Module

The faceplate of the INTKM01 module has one status indicator as shown in Figure 4-2.

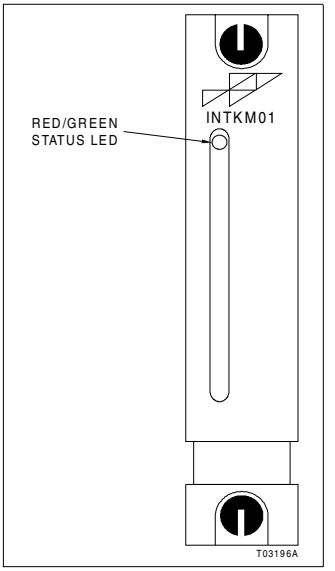


Figure 4-2. INTKM01 Front Panel

Modes of Operation

The INTKM01 module has two modes of operation: normal mode and diagnostics. The jumper E2 is used to select the two operating modes. The module status is signalled by a two-color status LED.

Normal

In the normal operating mode, the INTKM01 module performs the following operations:

- Transmits the sync time information through the time-sync link.
- Makes the absolute time available for the INSEM01 module.
- If the receiver is present it receives the time information and uses it to correct its own clock.

In this operating mode the INTKM01 module is online and the status LED is green. The INTKM01 module is offline after power-on when it is not initialized by the INSEM01 module and the receiver if present. In this operating mode the status LED is flashing green. In case of abnormal operation, the status LED assumes different colors, the meanings are described in Table 5-2.

Diagnostics

The INTKM01 module can execute a self-diagnostic procedure. To run the procedure it is necessary to set jumpers E1 and E2 as shown in Table 4-2.

Table 4-2. INTKM01 Jumpers - Diagnostics

Jumper	Position
E1	Not inserted
E2	1 - 2

To run the diagnostics, set the jumpers then insert the module into the module mounting unit. The diagnostics procedure executes tests of the main components of the module; the fault machine time test is run last. The status LED signals the test results. If the results are positive, the sequence shown in Table 4-3 will display on the LED. If this sequence does not occur, the results are negative.

Table 4-3. Red/Green Status LED - Diagnostic

Color	Time
Red	2 seconds
Green	1 second

If the diagnostics does not find errors the tests run continually. When the module is in diagnostic mode it is not available for normal operation.

IMSED01 and IMSET01 Module

The faceplate of IMSED01 module and the IMSET01 module has the following components as shown in Figure 4-3 and 4-4:

- Status LED.

- 16 digital input status LEDs.

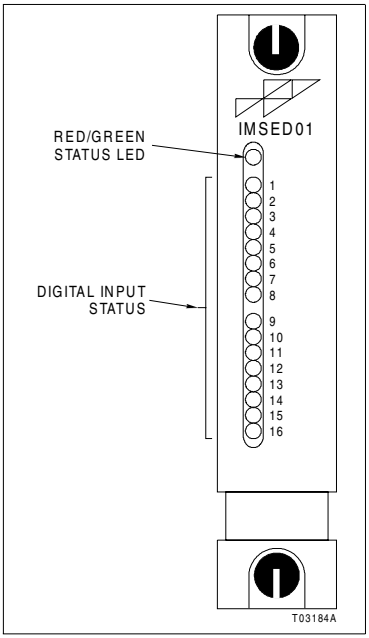


Figure 4-3. IMSED01 Front Panel

LED Status

The 16 LEDs located on the front panel of the module indicate the digital input status. These LEDs turn on when the corresponding channel is in the closed contact condition; they turn off when the corresponding channel is in the open contact condition.

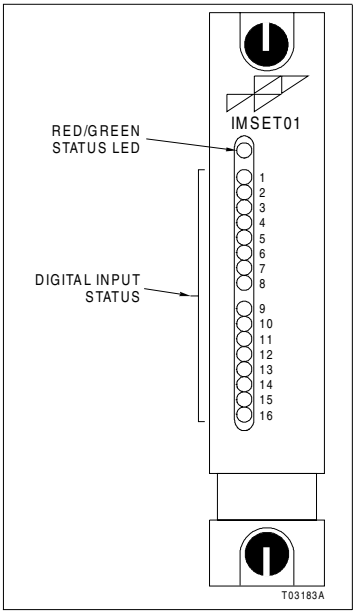


Figure 4-4. IMSET01 Front Panel

Modes of Operation

The IMSET01 module and the IMSED01 modules operate in two different modes: normal and diagnostics. The jumper E33 and E35 are used to select the two operating modes.

Normal

In the normal operating mode, the IMSET01 module and the IMSED01 modules perform the following operations:

- Acquisition of events relevant to digital inputs.
- Synchronization of the internal clocks.

During this operating mode, the status LED is green. In case of abnormal operation, the status LED changes as explained in the ***IMSED01 and IMSET01 Modules*** in Section 5.

Diagnostics

The IMSET01 module and the INSED01 modules can execute a self diagnostic procedure. To run this procedure, jumpers E33 and E35 must be set as shown in Table 4-4.

Table 4-4. INSED01 and IMSET01 Jumpers - Diagnostics

Jumper	Position
E33	Not inserted
E35	1 - 2

To run the diagnostics, set the jumpers then insert the module into the module mounting unit. This procedure executes the tests of the main components of the module; the machine fault timer test is run last.

If the diagnostics do not find errors the tests run continually. When the module is in diagnostic mode it is not available for normal operations.

If the results are positive, the sequence shown in Table 4-3 will display on the status LED. If this sequence does not occur, the results are negative.

Troubleshooting

Section 5

Introduction

This section explains the error indicators and corrective actions for the SOE modules.

INSEM01 Module

Troubleshooting the INSEM01 module is limited to viewing the contents of the error counters and the module status report from any human system interface. Refer to the instruction for the specific interface for information on module status reports.

INSEM01 module faceplate LEDs serve as error code displays. If errors occur while the INSEM01 module is operating, the status LED turns red and the lower eight LEDs on the INSEM01 module faceplate display error codes. Table 5-1 lists the error codes and corrective actions. The INSEM01 module displays error codes only when it is halted.

Table 5-1. INSEM01 Error Codes

LED 8 7 6 5 4 3 2 1	Code	Error Condition	Corrective Action
0 0 0 0 0 0 0 1	0X01	NVRAM checksum error	Initialize NVRAM Contact ABB
0 0 0 0 0 1 0 1	0X05	Config. error: undefined block	Check module status
0 0 0 0 0 1 1 0	0X06	Config. error: data type conflict	
0 0 0 0 1 0 1 1	0X0B	Init-NVRAM switch is set	1. Confirm NVRAM initialized 2. No action requested
0 0 0 0 1 1 0 0	0X0C	NVRAM partition open for write	Initialize NVRAM Contact ABB
0 0 0 0 1 1 0 1	0X0D	I/O expander bus error	Check I/O expander bus for connections to other modules
0 0 0 1 0 0 0 1	0X11	NVRAM write error	1. Check configuration 2. Correct faulty values 3. Re-execute configuration
0 0 0 1 0 0 1 0	0X12	INNIS01 module not responding	Replace the INNIS01 module
0 0 0 1 0 0 1 1	0X13	ROM checksum error	Contact ABB

Table 5-1. INSEM01 Error Codes *(continued)*

LED 8 7 6 5 4 3 2 1	Code	Error Condition	Corrective Action
0 0 0 1 1 0 0 1	0X19	SCSI port error	Reset INSEM01 module; replace if error continues
0 0 1 1 0 0 0 1	0X31	Microprocessor or memory fault exists	Replace INSEM01 module
0 0 1 1 0 0 1 0	0X32	An addressing or bus error occurred	Reset INSEM01 module; replace if error continues
0 0 1 1 0 0 1 1	0X33	Attempt to execute an invalid processor instruction	
0 0 1 1 0 1 0 0	0X34	Trace privilege violation	
0 0 1 1 0 1 0 1	0X35	Spurious/unassigned exception	
0 0 1 1 0 1 1 0	0X36	A divide by 0 or CHK instruction was expected	
0 0 1 1 1 0 0 1	0X39	Duplicate node number or ring	Change node number
0 0 1 1 1 1 1 1	0X3F	INSEM01 module was stopped because the user pressed the stop push button	Reset INSEM01 module
0 1 0 0 0 0 0 1	0X81	Initialization error	
0 1 0 0 0 1 0 1	0X85	Configuration error	1. Check configuration 2. Reset INSEM01 module
0 1 0 0 0 1 1 1, 0 1 0 0 1 0 1 0	0X87, 0X8A	SW errors	Contact ABB
0 1 0 0 1 0 1 1	0X8B	Network address error	1. Replace INNIS01 module 2. Contact ABB
0 1 0 0 1 1 0 0	0X8C	INTKM01 module error	INTKM01 module not working: check it for problems

A code that is not on this list may appear if a machine fault time-out occurs. Reset the module if this happens. The module has failed if the status LED remains red. Replace the INSEM01 module.

INTKM01 Module

Troubleshooting the INTKM01 module is limited to viewing the status of the red/green status LED during the normal operation of the module. Possible cases are listed in Table 5-2.

Table 5-2. INTKM01 Red/Green LED Conditions

LED Status	Module Status
Off	Not configured or stall condition is present on I/O expander bus
Green	Online and the stall condition does not exist on I/O expander bus
Green flashing	Offline
Red	Machine fault timer expiration
Orange	Machine fault timer disabled

To detect any errors run the self-diagnostic procedure described in the ***Diagnostics*** in Section 4. If the sequence of the red/green LED conditions is different from that listed in Table 4-3 the module must be replaced.

IMSED01 and IMSET01 Modules

Troubleshooting the IMSET01/IMSED01 modules is limited to viewing the status of the red/green LED during the normal operation of the module. Possible displays are shown in Table 5-3.

Table 5-3. IMSED01 and IMSET01 Red/Green Status LED Conditions

LED Status	Module Status
Off	Not configured or stall condition is present on the I/O expander bus
Green	Configured and synchronized and the controller is sensed on I/O expander bus
Green flashing	Configured but not synchronized
Red	Machine fault timer expiration
Orange	Machine fault timer disabled

To detect any errors run the self-diagnostic procedure described in the ***Diagnostics*** in Section 4. If the red/green LED status sequence is red the module must be replaced.

Module Pin Assignments

The following sections provide the SOE module pin assignments.

INTKM01 Module

The INTKM01 module has three card-edge connectors (P1, P2 and P3). P1 is used to supply power to the module and receive the power fail interrupt signal emitted by the power supply unit. Connector P2 is used for the interconnection with the I/O expander bus. Connector P3 is used to transmit sync time information and to receive the IRIG-B time code from the NTST01 unit. Tables 5-4 through 5-6 list the P1, P2 and P3 pin assignments.

Table 5-4. INTKM01 P1 (Power) Pin Assignment

Pin	Description
1	+5 VDC
2	+5 VDC
3	NC
4	NC
5	GND (5 VDC)
6	GND (5 VDC)
7	NC
8	NC
9	PFI
10	NC
11	NC
12	NC

NOTE: Odd numbers are on the component side of board; NC=not connected

Table 5-5. INTKM01 P2 (I/O Expander Bus) Pin Assignment

Pin	Description
1	Data bit 1
2	Data bit 0
3	Data bit 3
4	Data bit 2
5	Data bit 5
6	Data bit 4
7	Data bit 7
8	Data bit 6

Table 5-5. INTKM01 P2 (I/O Expander Bus) Pin Assignment *(continued)*

Pin	Description
9	Bus clock
10	Sync
11	NC
12	NC

NOTE: Odd numbers are on the component side of board; NC=not connected

Table 5-6. INTKM01 P3 (Time Signals I/O) Pin Assignment

Pin	Description	Pin	Description
1	NC	A	NC
2	NC	B	NC
3	NC	C	NC
4	NC	D	NC
5	NC	E	NC
6	NC	F	NC
7	IRIG_B+	H	IRIG_B-
8	Reserved	J	Reserved
9	Reserved	K	Reserved
10	Rx presence NTST01+	L	Rx presence NTST01-
11	Reserved	M	Reserved
12	Tx sync time information+	N	Tx sync time information-
13	Reserved	P	Reserved
14	NC	R	NC
15	GND	S	NC

NOTE: Numbers 1 through 15 are on the solder side of board; NC=not connected.

IMSED01 and IMSET01 Modules

The IMSET01 and the IMSED01 modules have three card-edge connectors (P1, P2 and P3). P1 is used to supply power to the module and receive the power fail interrupt signal emitted by the power supply unit. P2 is used for the interconnection with I/O expander bus. Connector P3 is used to acquire the 16 digital inputs from NTDI01 unit or the NTU-7I1 unit and, in the IMSET01 module, to receive the time signal from the NTST01 unit Tables 5-7 and 5-8 list the P1 and P2 pin assignments,

which are identical for both modules. Table 5-9 lists the P3 pin assignments for the IMSET01 module. Table 5-10 lists the P3 pin assignments for the IMSED01 module.

Table 5-7. IMSED01 and IMSET01 P1 (Power) Pin Assignments

Pin	Description
1	+5 VDC
2	+5 VDC
3	NC
4	NC
5	GND (5 VDC)
6	GND (5 VDC)
7	NC
8	NC
9	PFI
10	NC
11	NC
12	NC

NOTE: Odd numbers are on the component side of board; NC=not connected

Table 5-8. IMSED01 and IMSET01 P2 (I/O Expander Bus) Pin Assignments

Pin	Description
1	Data bit 1
2	Data bit 0
3	Data bit 3
4	Data bit 2
5	Data bit 5
6	Data bit 4
7	Data bit 7
8	Data bit 6
9	Bus clock
10	Sync
11	NC
12	NC

NOTE: Odd numbers are on the component side of board; NC=not connected

Table 5-9. IMSET01 P3 (Digital Inputs and Time Signals) Pin Assignment

Pin	Description	Pin	Description
1	DI 1-	26	DI 1+
2	DI 2-	27	DI 2+
3	DI 3-	28	DI 3+
4	DI 4-	29	DI 4+
5	DI 5-	30	DI 5+
6	DI 6-	31	DI 6+
7	DI 7-	32	DI 7+
8	DI 8-	33	DI 8+
9	DI 9-	34	DI 9+
10	DI 10-	35	DI 10+
11	DI 11-	36	DI 11+
12	DI 12-	37	DI 12+
13	DI 13-	38	DI 13+
14	DI 14-	39	DI 14+
15	DI 15-	40	DI 15+
16	DI 16-	41	DI 16+
17	NC	42	NC
18	NC	43	NC
19	NC	44	NC
20	NC	45	NC
21	NC	46	NC
22	NC	47	NC
23	Rx sync time info	48	Rx sync time info
24	Rx presence NTST01-	49	Rx presence NTST01+
25	GND	50	GND

NOTE: Numbers 1 through 25 are on the solder side of board; NC=not connected

Table 5-10. IMSED01 P3 (Digital Inputs) Pin Assignments

Pin	Description	Pin	Description
1	DI 1-	26	DI 1+
2	DI 2-	27	DI 2+
3	DI 3-	28	DI 3+
4	DI 4-	29	DI 4+
5	DI 5-	30	DI 5+
6	DI 6-	31	DI 6+
7	DI 7-	32	DI 7+
8	DI 8-	33	DI 8+
9	DI 9-	34	DI 9+
10	DI 10-	35	DI 10+
11	DI 11-	36	DI 11+
12	DI 12-	37	DI 12+
13	DI 13-	38	DI 13+
14	DI 14-	39	DI 14+
15	DI 15-	40	DI 15+
16	DI 16-	41	DI 16+
17	NC	42	NC
18	NC	43	NC
19	NC	44	NC
20	NC	45	NC
21	NC	46	NC
22	NC	47	NC
23	NC	48	NC
24	NC	49	NC
25	NC	50	NC

NOTE: Numbers 1 through 25 are on the solder side of board; NC=not connected.

NSTS01 Termination Unit

Tables 5-11 to 5-13 show TB1, TB2 and TB3 terminal block assignment. Tables 5-14 and 5-15 show the pinouts for the P1 and P2 connectors of the NTST01 termination unit.

Table 5-11. NTST01 TB1 Assignments

Pin	Signal
1	OUTPUT + sync link with bypass
2	OUTPUT - sync link with bypass
3	GND OUTPUT for shield
4	INPUT + sync link
5	INPUT - sync link
6	GND INPUT for shield

Table 5-12. TST01 TB2 Assignments

Pin	Signal
1	OUTPUT + sync link 1
2	OUTPUT - sync link 1
3	GND OUTPUT for shield
4	OUTPUT + sync link 2
5	OUTPUT - sync link 2
6	GND OUTPUT for shield

Table 5-13. NTST01 TB3 Assignments

Pin	Signal
1	OUTPUT + sync link 3
2	OUTPUT - sync link 3
3	GND OUTPUT for shield
4	OUTPUT + sync link 4
5	OUTPUT - sync link 4
6	GND OUTPUT for shield

Table 5-14. NTST01 P1 Pin Assignments

Pin	Signal
1	+ Tx sync time info (to other NTST01)
2	- Tx sync time info (to other NTST01)
3	GND
4	NC
5	NC
6	NC

Table 5-15. NTST01 P2 Pin Assingments

Pin	Signal
1	+ Rx sync time info (to IMSET01 module) + Rx IRIG-B (to INTKM01 module)
2	+ Rx sync time info (to IMSET01 module) - Rx IRIG-B (to INTKM01 module)
3	NC
4	+ NTST01_OK (to IMSET01, INTKM01 modules)
5	- NTST01_OK (to IMSET01, INTKM01 modules)
6	Reserved
7	GND
8	Reserved
9	Reserved
10	Reserved
11	+ Tx sync time info (from INTKM01 module)
12	- Tx sync time Info (from INTKM01 module)

Maintenance

Section 6

Introduction

The reliability of any stand-alone product or control system is affected by the maintenance of the equipment. ABB Automation recommends that all equipment users practice a preventive maintenance program that will keep the equipment operating at an optimum level.

This section presents procedures that the customer should be able to perform on site. These preventive maintenance procedures should be used as a guideline to assist in establishing good preventive maintenance practices.

Personnel performing preventive maintenance should meet the following qualifications.

- Maintenance personnel should be qualified electrical technicians or engineers that know the proper use of test equipment.
- Maintenance personnel should be familiar with the module mounting unit, have experience working with process control systems, and know what precautions to take when working on live AC and DC systems.

Preventive Maintenance Schedule

Table 6-1 is the preventive maintenance schedule for the SOE modules. The table lists the preventive maintenance tasks in groups according to their specified maintenance interval. Instructions for tasks that require further explanation are covered in the *Preventive Maintenance Procedures* of this section.

NOTE: The preventive maintenance schedule is for general purposes only. Your applications may require special attention.

Equipment and Tools Required

Tools and equipment required for maintenance procedures are:

Table 6-1. Preventive Maintenance Schedule

Task	Frequency
Check cabinet, module mounting unit backplane assembly, fan assembly, power entry panel, SOE modules and termination devices for dust. Clean as necessary using an antistatic vacuum. If circuit board cleaning is necessary, refer to procedure.	Every six months or during plant shutdown, whichever occurs first.
Check all signal, power and ground connections that are associated with the SOE modules. Verify that they are secure. Refer to procedure.	

- Antistatic vacuum.
- Screwdriver (medium length).
- Isopryl alcohol (99.5 percent electronic grade).
- Distilled water.
- Compressed air.
- Foam-tipped swabs.
- Lint-free cloths.
- Nonabrasive eraser.

Preventive Maintenance Procedures

This section covers tasks from Table 6-1 that require specific instructions or further explanation.

- Cleaning printed circuit boards and edge connectors.
- Checking signal, power and ground connections.

Printed Circuit Board Cleaning

There are several circuit board cleaning procedures in this section. These procedures cover circuit board cleaning and washing, cleaning edge connectors and circuit board laminate between edge connectors. Use the procedures that meet the needs of each circuit board. Remove all dust, dirt, oil, corrosion or any other contaminant from the circuit board.

Do all cleaning and handling of the printed circuit boards at static safe work stations. Always observe the steps under

Special Handling in Section 3 when handling printed circuit boards.

WARNING

Never clean electrical parts or components with live power present. Doing so exposes you to an electrical shock hazard.

Wear eye protection whenever working with cleaning solvents. When removing solvents from printed circuit boards using compressed air, injury to the eyes could result from splashing solvent as it is removed from the printed circuit board.

General Cleaning and Washing

If the printed circuit board needs minor cleaning, remove dust and residue from the printed circuit board surface using clean, dry, filtered compressed air or an antistatic field service vacuum cleaner.

To wash the printed circuit board:

1. Clean the printed circuit board by spraying or wiping it with isopropyl alcohol (99.5% electronic grade). Use a foam-tipped swab to wipe the circuit board.

2. Remove excess solvent by using compressed air to blow it free of the circuit board.

Edge Connector Cleaning

1. Use a solvent mixture of 80% isopropyl alcohol (99.5% electronic grade) and 20% distilled water.

2. Soak a lint-free cloth with the solvent mixture.

3. Work the cloth back and forth parallel to the edge connector contacts.

4. Repeat with a clean cloth that is soaked with the solvent mixture.

5. Dry the edge connector contact area by wiping with a clean lint-free cloth.

To clean tarnished or deeply stained edge connector contacts:

1. Use a nonabrasive eraser to remove tarnish or stains. Fiberglass or nylon burnishing brushes may also be used.

2. Minimize electrostatic discharge by using the 80/20 isopropyl alcohol/water solution during burnishing.

3. Do not use excessive force while burnishing. Use only enough force to shine the contact surface. Inspect the edge connector after cleaning to assure no loss of contact surface.

4. Wipe clean with a lint-free cloth.

Checking Connections

NOTE: Power to the cabinet should be off while performing this preventive maintenance task.

WARNING

There are exposed AC and DC connections inside the cabinet. These exposed electrical connections present a shock hazard that can cause injury or death.

If input or output circuits are a shock hazard after disconnecting system power at the power entry panel, then the door of the cabinet containing these externally powered circuits must be marked with a warning stating that multiple power sources exist.

Check all signal wiring, power and ground connections within the cabinet to verify their integrity. When checking connections, always turn a screw, nut or other fastening device in the direction to tighten only. If the connection is loose, it will be tightened. If the connection is tight, the tightening action will verify that it is secure. There must not be any motion done to loosen the connection.

1. Verify that all power connections within the cabinet are secure.

2. Verify that all wiring connections to the termination unit, or termination module are secure.

Repair and Replacement

Section 7

Introduction

This section explains the replacement procedures for the SOE modules. There are no special tools required to replace any SOE module.

Module Repair and Replacement

If any SOE module is faulty, replace it with a new one. ***Do not*** try to repair the module; replacing components may affect the module performance. It is not required to secure system power during replacement procedures. To replace a module:

1. Push and turn the two front panel captive retaining latches one half turn to unlatch the module. It is unlatched when the slots on the latches are vertical and the open end of the slot faces away from the module.

2. Slide the module out of the module mounting unit.

3. Configure the replacement module switch and jumper settings. Insure they are set the same as the original module.

4. In the same slot assignment as the original module, align the replacement module with the guide rails in the module mounting unit. Slide it until the front panel is flush with the top and bottom of the module mounting unit frame.

5. Push and turn the two captive retaining latches on the module faceplate one half turn to the latched position. It is latched when the slots on the latches are vertical and the open ends face the center of the module.

6. Return to normal operation.

Satellite Receiver System (SRS) Appendix A

Introduction

Satellite receiver is an item purchased directly from the vendor. Satellite receivers providing date in IRIG-B format are supported.

The SRS Synchronized Time Code Unit is mounted in a compact 1.75-inch rack package. The fourth generation microprocessor-based modular design offers state-of-the-art accuracy, convenience, flexibility and reliability. The SRS consists of a small, rugged chassis which provides the platform for the front panel controls and displays, the power supply, GPS receiver, and the timing processor.

The front panel high intensity LED display of time-of-year is enhanced by the alphanumeric LCD for display of setup and operating parameters.

SRS Features

The SRS connected to the INTKM01 module must have:

- IRIG-B time code output in DC level shift format.
- 50 ohm driver on IRIG-B output.

INTKM01 Connection

Observe the following steps when connecting the SRS to the INTKM01 module's termination unit.

1. Connect the SRS IRIG-B output with the NTST01 P4 connector using 50 ohm coax cable (RG58U) with BNC connectors on both ends. The maximum cable length is 92 meters (300 feet).

2. Set the 50 ohm termination on NTST01 for IRIG-B signal (jumper E9 inserted).

For additional information about the SRS consult the manufacturer's product manual.

NTST01 Termination Unit

Appendix B

Introduction

The NTST01 unit can be connected to the INTKM01 module or to the IMSET01 module, in sequential or star network connections. The cable and the jumper configurations are different, depending on the connected modules and the kind of connection. Figure B-1 shows NTST01 unit connector and jumpers locations.

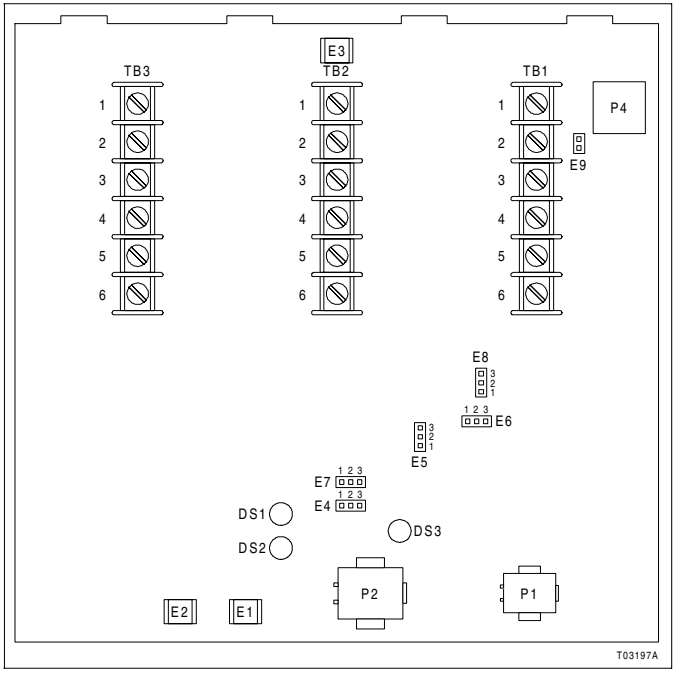


Figure B-1. NTST01 Termination Unit

IMSET01 Module

The connections of the NTST01 unit to the IMSET01 module and the corresponding jumper settings are different for sequential and star network connections. The connections in the sequential network are shown in Figure B-2, and the corresponding jumper settings are indicated in Table B-1.

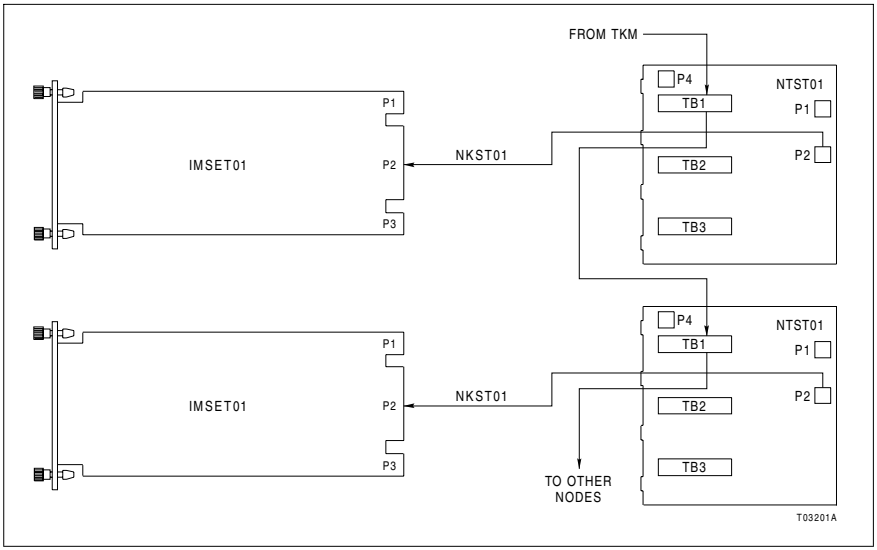


Figure B-2. NTST01 Sequential Network Connection

Table B-1. NTST01 Input - Connection to IMSET01 Module (Primary)

Jumper	Position
E4	1 - 2
E5	1 - 2
E6	1 - 2
E7	1 - 2
E8	1 - 2

In a star network connection, shown in Figure B-3, in addition to a primary NTST01 unit, which is the termination unit of the

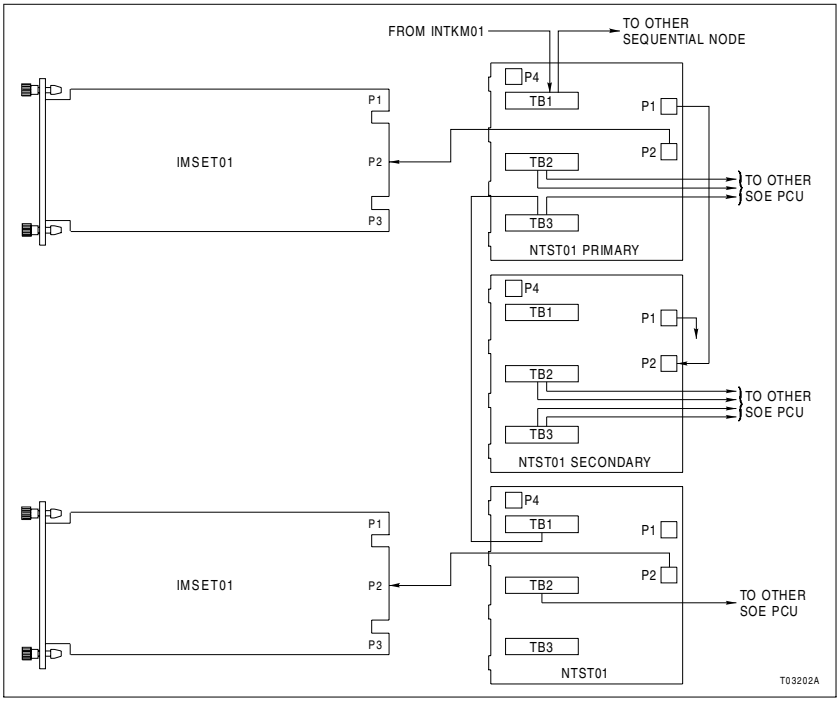


Figure B-3. NTST01 Star Network Connection

IMSET01 module, there can be one or more secondary NTST01 units. If the four lines provided by the primary NTST01 unit would not be sufficient for the network connection. The configuration of the primary NTST01 unit is the same as those for the sequential network connection.

The jumper settings of the secondary NTST01 are indicated in Table B-2.

Table B-2. NTST01 Jumpers - Star Network (Secondary)

Jumper	Position
E4	1 - 2
E5	1 - 2
E6	1 - 2

Table B-2. NTST01 Jumpers - Star Network (Secondary) *(continued)*

Jumper	Position
E7	2 - 3
E8	1 - 2

INTKM01 Module

The NTST01 unit is used by the INTKM01 module to transmit the sync time information to the IMSET01 modules. Table B-3 shows the NTST01 jumper setting for INTKM01 connection. Figure B-2 shows the location of the jumpers and the connectors on NTST01 unit.

Table B-3. NTST01 Jumper Setting

Jumper	Position
E4, E5, E6, E7, E8	1-2

When the termination unit is used to connect the receiver to the INTKM01 module refer to Appendix A.

Physical Installation

1. Insert the tabs on the circuit board into the proper slots on the termination panel stand-off and slide the unit into position.

2. Secure the termination unit to the field termination panel with two screws.

3. Connect the cables as shown in Figures B-2 and B-3 and in Table B-4.

Table B-4. Termination Unit Cables

Device	Connector	Cable	Cable Length
INTKM01	P2	NKTK01	61 m (200 ft)
IMSET01	P2	NKST01	61 m (200 ft)
Receiver	P4	RG58/U COAX (with BNC)	100 m (300 ft)
NTST01	P1	P.N. GM3.0086.040.00	61 m (200 ft)
I/O primary link	TB1	RG22B/U TWINAX	Refer to specifications
Out sync link 1 ÷ 4	TB2, TB3	RG22B/U TWINAX	Refer to specifications

Power Wiring

CAUTION	**Turn off cabinet power before doing any termination unit wiring. Failure to do so could result in equipment damage. Do not apply power until all wire connections have been verified.**

There are three terminals that provide power and ground connections. Figure 3-2 shows component location for the INTKM01 unit. E3 is common chassis and termination unit ground, E2 is the +24 VDC terminal.

1. Attach a 14 AWG wire (2.1 sq-mm) from the +24 VDC Faston of the DC bus to the E2 terminal on the NTST01 unit.

2. Attach a 14 AWG wire (2.1 sq-mm) from the chassis ground to the E3 terminal on the NTST01 unit.

3. Attach a 14 AWG wire (2.1 sq-mm) from the I/O common to the E1 terminal on the NTST01 unit.

Refer to the ***Modular Power System II*** instruction for further details.

NTU-7I1 Termination Unit

Appendix C

Introduction

The NTU-7I1 Isolated Digital Input Termination Unit is an interface for input signals. It provides the isolation and the physical connection points for process field wiring.

The jumpers and the dipshunts on the NTU-7I1 unit (Fig. C-2) are used to connect the termination unit to the I/O expander bus module and the input channels to the field device.

I/O Expander Bus Dipshunts

Table C-1 shows the termination unit dipshunts setting to connect the termination unit to the I/O expander bus module.

Table C-1. I/O Expander Bus Setting Dipshunts

Module	Dipshunts on FIR-791	Shorting Bars Setting							
		1	2	3	4	5	6	7	8
IMSET01 IMSED01	XU 1	1	0	1	0	1	0	1	0
	XU 2	1	0	1	0	1	0	1	0
	XU 3	1	0	1	0	1	0	1	0
	XU 4	1	0	1	0	1	0	1	0

NOTE: 1 = shorting bar intact; 0 = shorting bar removed

Configuring Inputs

Table C-2 shows the termination unit jumper settings for digital inputs. Check the jumpers before installation of the termination unit. The jumpers may be changed during installation. Figure C-2 shows the NTU-7I1 units terminal assignments.

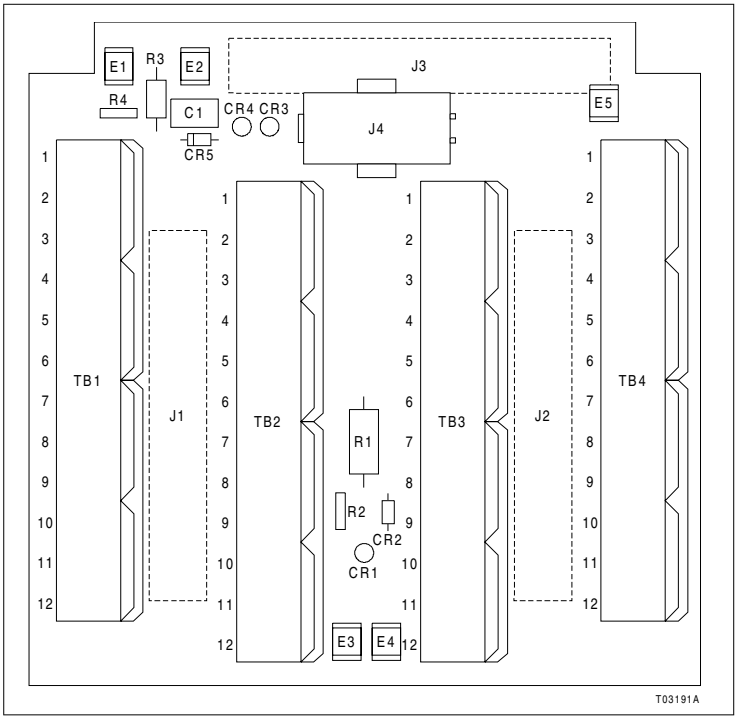


Figure C-1. Upper Board FJB-793 of NTU-711

Table C-2. Digital Input Jumper Setting

Channel	Power Setting on FIR-791			Input Voltage Setting on FIR-791				
	Jumper	System	External	Jumper	24 VDC	48 VDC	125 VDC	120 VAC
CH1A	E17	1	0	E31	A-C	A-B	A-B	A-B
	E18	0	1	E29	A-C	A-C	A-B	A-B
	E19	1	0	E1	A-B	A-B	A-B	A-C
CH2A	E37	1	0	E51	A-C	A-B	A-B	A-B
	E38	0	1	E49	A-C	A-C	A-B	A-B
	E39	1	0	E2	A-B	A-B	A-B	A-C
CH3A	E57	1	0	E71	A-C	A-B	A-B	A-B
	E58	0	1	E69	A-C	A-C	A-B	A-B
	E59	1	0	E5	A-B	A-B	A-B	A-C

Table C-2. Digital Input Jumper Setting *(continued)*

Channel	Power Setting on FIR-791			Input Voltage Setting on FIR-791				
	Jumper	System	External	Jumper	24 VDC	48 VDC	125 VDC	120 VAC
CH4A	E77	1	0	E91	A-C	A-B	A-B	A-B
	E78	0	1	E89	A-C	A-C	A-B	A-B
	E79	1	0	E6	A-B	A-B	A-B	A-C
CH5A	E23	1	0	E35	A-C	A-B	A-B	A-B
	E24	0	1	E33	A-C	A-C	A-B	A-B
	E25	1	0	E7	A-B	A-B	A-B	A-C
CH6A	E43	1	0	E55	A-C	A-B	A-B	A-B
	E44	0	1	E53	A-C	A-C	A-B	A-B
	E45	1	0	E8	A-B	A-B	A-B	A-C
CH7A	E63	1	0	E75	A-C	A-B	A-B	A-B
	E64	0	1	E73	A-C	A-C	A-B	A-B
	E65	1	0	E9	A-B	A-B	A-B	A-C
CH8A	E83	1	0	E95	A-C	A-B	A-B	A-B
	E84	0	1	E93	A-C	A-C	A-B	A-B
	E85	1	0	E10	A-B	A-B	A-B	A-C
CH1B	E26	1	0	E36	A-C	A-B	A-B	A-B
	E27	0	1	E34	A-C	A-C	A-B	A-B
	E28	1	0	E11	A-B	A-B	A-B	A-C
CH2B	E46	1	0	E56	A-C	A-B	A-B	A-B
	E47	0	1	E54	A-C	A-C	A-B	A-B
	E48	1	0	E12	A-B	A-B	A-B	A-C
CH3B	E66	1	0	E76	A-C	A-B	A-B	A-B
	E67	0	1	E74	A-C	A-C	A-B	A-B
	E68	1	0	E13	A-B	A-B	A-B	A-C
CH4B	E86	1	0	E96	A-C	A-B	A-B	A-B
	E87	0	1	E94	A-C	A-C	A-B	A-B
	E88	1	0	E14	A-B	A-B	A-B	A-C
CH5B	E20	1	0	E32	A-C	A-B	A-B	A-B
	E21	0	1	E30	A-C	A-C	A-B	A-B
	E22	1	0	E15	A-B	A-B	A-B	A-C
CH6B	E40	1	0	E52	A-C	A-B	A-B	A-B
	E41	0	1	E50	A-C	A-C	A-B	A-B
	E42	1	0	E16	A-B	A-B	A-B	A-C
CH7B	E60	1	0	E52	A-C	A-B	A-B	A-B
	E61	0	1	E50	A-C	A-C	A-B	A-B
	E62	1	0	E16	A-B	A-B	A-B	A-C

Table C-2. Digital Input Jumper Setting *(continued)*

Channel	Power Setting on FIR-791			Input Voltage Setting on FIR-791				
	Jumper	System	External	Jumper	24 VDC	48 VDC	125 VDC	120 VAC
CH7B	E60	1	0	E72	A-C	A-B	A-B	A-B
	E61	0	1	E70	A-C	A-C	A-B	A-B
	E62	1	0	E3	A-B	A-B	A-B	A-C
CH8B	E80	1	0	E92	A-C	A-B	A-B	A-B
	E81	0	1	E90	A-C	A-C	A-B	A-B
	E82	1	0	E4	A-B	A-B	A-B	A-C

NOTE: 1 = intact jumper; 0 = removed jumper.

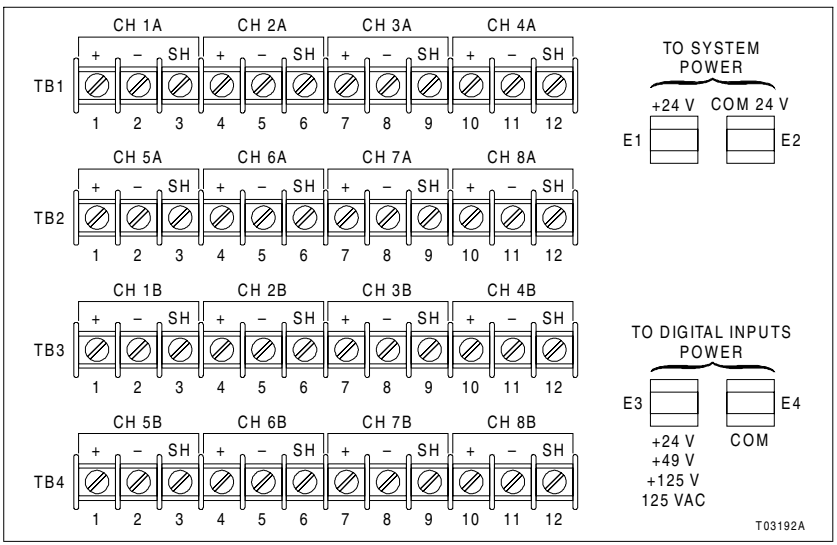


Figure C-2. NTU-711 Terminal Assignments

NTDI01 Termination Unit

Appendix D

Introduction

The NTDI01 Digital Input Termination Unit is an interface for input signals. It provides the physical connection points for process field wiring.

Configure Inputs

Dipshunts on the NTDI01 unit configure the digital inputs. The digital slave input (DSI) module accepts inputs of 24 VDC, 125 VDC and 120 VAC.

Figure D-1 shows the NTDI01 unit dipshunt without strapping and the digital signal path from the field device (contact) to the DSI module for a termination unit application. Refer to Table D-1 to determine the dipshunt strapping to configure your application. Figure D-2 shows the terminal assignments for the digital input signals. Refer to this figure when connecting field wiring to the NTDI01 unit.

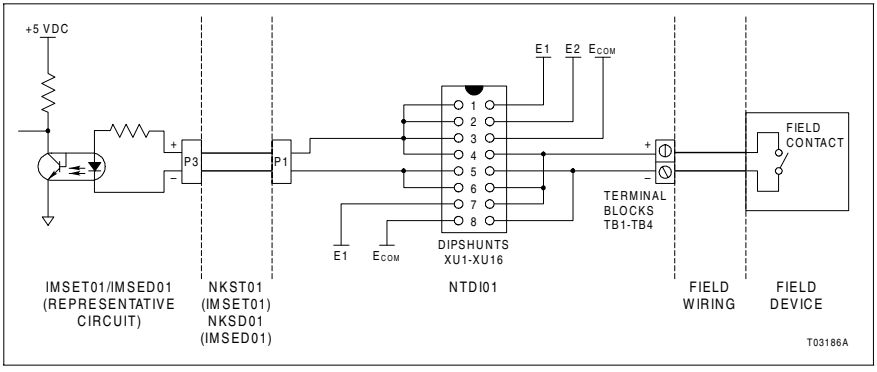


Figure D-1. NTDI01 Dipshunt

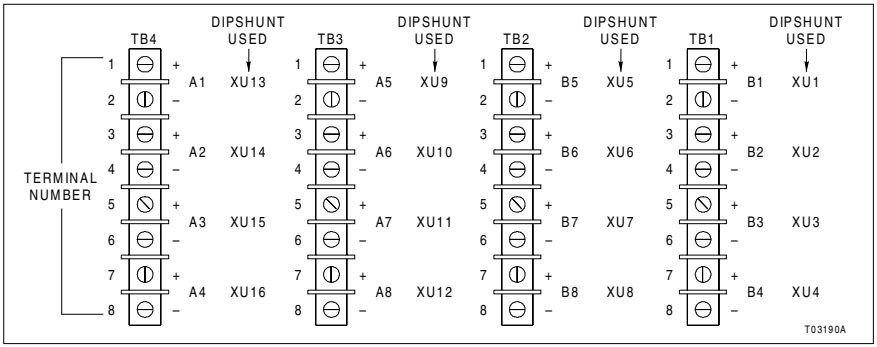


Figure D-2. NTDI01 Terminal Assignments

Table D-1. NTDI01 Dipshunt Configuration

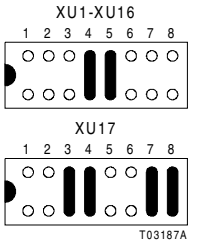
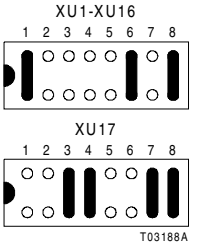
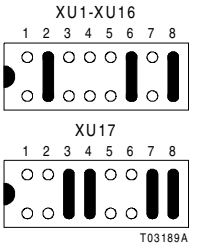
Application/Signal Type	XU01
Field powered contact	

Table D-1. NTDI01 Dipshunt Configuration *(continued)*

Application/Signal Type	XU01
System powered from E1, 24 VDC, 125 VDC, 120 VAC	
System powered from E2, 24 VDC, 125 VDC, 120 VAC	

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