System 9000TS
Sequence of Events Recorder

1ms Event Recorder and combined Annunciator

Modular, rack mounting design expandable to over 4000 inputs

1ms time stamping of events across the whole system

Up to 15,000 events stored per rack in distributed non-volatile memory

Flexible auto-shelving facility to avoid nuisance alarms

Fully programmable via the programming port on the Interface Card using Windows-based configuration software

Fully integrated alarm annunciator functionality

Wide range of optional displays

The System 9000TS Sequence of Events Recorder leads the way in the latest technically advanced event and alarm management systems.

Built on a rugged hardware platform suitable for the most severe of industrial environments this unit will provide true time-stamping of event occurence to a resolution of 1ms. Using the synchronisation input this can also be related to real time.

Using the optional integrated alarm annunciator features it is possible to build a system that will capture, record, print and display events and alarms both for immediate action on the plant and for later analysis to find the prime cause of the failure.

The system is available with various different display and output options to suit individual applications.

Features & Benefits

- Provides independent annunciation and time stamping of critical plant alarms whilst communicating back to the host DCS, PLC, ESD, SCADA or computer system
- Fully programmable, for all system features which can be stored and downloaded as required via the integral Interface Card
- Suitable for systems from a sixteen-input package to a plant-wide alarm/recording system
- Total flexibility in choice of system size, display style, operation and options
- Field proven technology, with hundreds of thousands of alarm points already in operation worldwide

With personnel safety, increased regulation and the high cost of plant shutdowns the need to continuously monitor, record and analyse system performance has become more important than ever before.

The traditional back-lit annunciator will provide the clearest method of alerting the operator this can now be combined with accurate time tagging of the events. In the automated control and protection used in today's modern plant a typical failure can result in alarm bursts of over 100 alarms within the first few seconds. The key issue in these situations is not only to identify the alarms and inform the operator but also to indentify the primary cause of failure within the process.

The System 9000TS has been developed with this in mind and will capture a change in state on digital events across the entire network to within a 1ms resolution.

Total Configurability
All the facilities are field programmable using RTK's Windows-based setup software provided with the equipment.

All features are configurable for each individual input and output channel and can easily be set-up in minutes without the need to learn a special programming language.

All the alarm sequences specified in the ISA publication "Annunciator Sequences and Specifications" are available in addition to a wide range of additional features.

Total Flexibility
The modular construction and the advanced programming facilities mean that the System 9000TS combined SER and alarm system can be supplied to match any process alarm application. Standard 19" Racks provide almost unlimited system expansion and the user can configure each channel from a range of pre-defined features and embedded sequences as required. Configuration changes can easily be generated off-line and downloaded.

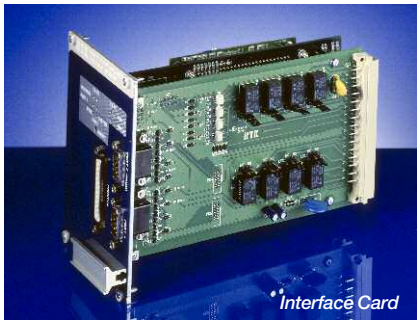
High Density Packaging
Standard 3U 19" Euroracks with rear access terminals are used on the System 9000TS. The first rack houses the Interface Card and up to 13 off Sixteen Channel Input/Output Cards. Extension racks are suitable for 14 off Sixteen Channel Input/Output Cards.

Multiple racks are interconnected using factory supplied ribbon cables/connectors to form large systems up to 4000 channels.

Interfacing
The System 9000TS is ideally suited to interface to third party plant equipment. Systems are always supplied with a Modbus RS485 serial interface and options exist for Ethernet and protocol converters.

Eight system relays are provided as standard for use as watchdog, system faults, horn and group relays. Individual repeat relays for each channel can be provided as an option

Using the powerful communications features it is possible to interface to existing PLCs, SCADA systems, Emergency Shutdown Systems and plant-wide distributed control systems. The Annunciator can monitor and display critical alarms and communicate the results into the normal monitoring systems, giving another level of safety and independence from the general monitoring or control system.


Interface Card

Event Storage
The system has a unique distributed method of storing events so that even following a cascade of alarms or a power failure up to 15,000 events per rack are stored within the solid-state, non-volatile memory.

Expandability
Each 19" rack is supplied fully equipped allowing simple expansion with the addition of Input, Output or Relay Cards. If a larger system is required additional racks can be interconnected to the existing unit using factory supplied ribbon cables and connectors to link system features.

Interface Card
Each system is supplied with an Interface Card. Customer connections for remote printing and programming are provided on the front of this card.

Configurable system relay outputs and the RS485 serial output are available on the rear of the associated chassis. Once configured, settings are stored on EEPROM on the individual cards.

In addition, the Interface Card filters and protects the incoming 24VDC supply and provides real time synchronisation to the system.

Nuisance Alarms
Each alarm can be set to automatically inhibit (shelve) if the alarm frequency exceeds configured parameters and are therefore considered invalid. Alarms are automatically re-instated once they return to normal patterns.

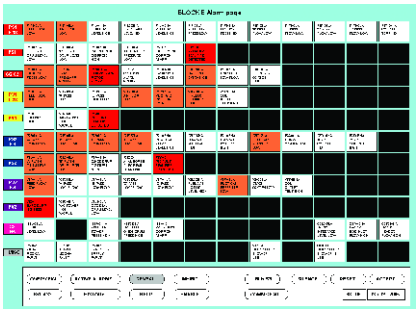
Features & Benefits

Isolation
All customer inputs to the system are provided with optical isolation. This enables the system to operate without deterioration or disturbance in environments of extreme electrical noise.

Inputs
Each optically-coupled input can be set to operate from a normally open or normally closed volt free contact powered via the annunciator at 24VDC. Alternative configurations are available for direct powered inputs from 24V, 48V, 110V and 250V AC/DC if required.

Servicing
All alarm ways are configured by plugging into the programming port on the Interface Card and downloading the settings from the Windows Setup Software supplied with the system. In the unlikely event of a card failure a new card installed into the system will be automatically configured to the original configuration.

Mounting
Industry standard 3U 19" racks with rear access, rising clamp terminals mounted on the rear of the chassis for customer wiring. As an option quick disconnect terminals with locking screws are available.



Power Supply
The supply voltage range for the system is wide enough for unregulated and battery backed supplies. The nominal 24V DC supply can be anywhere within the range 19-36V DC without affecting system performance.

Reprogramming
The cost of replacement ICs and on-site visits to change cards is completely eliminated with the System 9000TS. All functions can be easily and permanently changed using the setup software provided with the system. No special programming skills are required, features are simply enabled or disabled in software.

Pushbutton Inputs
The standard requirement for the majority of alarm annunciators is 3 pushbuttons for Lamp Test, Accept and Reset. The System 9000TS provides these functions as standard and 5 additional control inputs are available for more complex applications if required. The additional control inputs can be enabled or disabled using the RTK supplied software ultility. The additional functions are Silence, System Test, First-up Reset, Sleep and Horn Inhibit.

Card Types

Interface Card (P925TS-X)
Provides a link between the system I/O and the outside world with the following outputs
- RS485 serial port
- Power input
- Parallel printer port
- Synchronisation
- Programming port

Input Card (P925TS-I)
Connects to the alarm and pushbutton inputs, time-stamps to 1ms and buffers the events

Output Card (P925TS-0)
Provide the drive to external display facia to show alarm information to standard ISA sequences

Relay Card (P925TS-R)
This card is driven from the Input Card and gives an individual repeat relay per alarm input.

Relay Outputs
The standard system has outputs for all the commonly used functions, such as horn, watchdog, group and system fault relays. The watchdog relay is always provided, this will trip if any general fault occurs with the electronics. In addition to this there are eight further configurable relays which can be set as required up to a maximum of 8 group relays, 4 horn relays or various system fault relays. Each alarm way can also be supplied with individual repeat relay outputs, user configurable to follow the alarm contact or follow the alarm logic.

Displays
The System 9000TS is designed to work with almost any type of remote display ie. conventional backlit lamp or LED displays individual panel lamps or mimic diagrams RTK Instruments offer a range of display products to complement the 9000TS, these are detailed in the Display Facias datasheet.

Combined Alarm System
The System 9000TS can be supplied as a standalone Sequence of Events Recorder or with Output Cards which will provide a fully integrated alarm and event management system. Various card combinations are available to build up systems to suit the exact application.

Advanced Communications
All systems are supplied with the RS485 communications feature in addition to outputs for printers, programming and synchronisation. These outputs are available to link to the wider plant equipment to log and store events and alarms as they occur for later analysis if required. Additonal communications will also be available to provide ethernet, profibus, dual redundant communications etc.

Fully Programmable
Each input channel can be set to suit individual applications, for example: input time delay, alarm sequence, priority, grouping, and channel description. All these features can be enabled or disabled and stored using the RTK supplied configuration software. System parameters can be easily stored for retrieval at a later date if required.

Flexible System designs
RTK can supply the 9000TS system components as loose items for integration by others or fully integrated within industry standard wall mounting or floor standing panels configured to individual specifications.

Software and Printing Facilities

The majority of the features listed are supplied as standard as part of the normal software. This allows the system to be configured to match individual applications, RTK also offer full software integration enabling us to provide complete systems, undertake programming and commissioning. Please consult our Sales Office for further information on Alarm Management Software solutions.

Event Storage

The S9000TS uses an advanced, powerful inbuilt processor system complete with non-volatile memory to store both system settings and event and alarm data. The data storage system is designed without using any components with moving parts such as Hard Disk drives to provide the greatest system reliability possible. The software is programmed for all the system settings via the front mounted programming port using a standard RS232 output from a standard PC.

System Setup

The RTK supplied configuration software allows the user to enable/disable features and assign alarm text ie.

- 60 character of text for alarm messages
- Event prefix for both alarm and return to normal states
- Normally open or closed inputs
- Input time delays
- Alarm priorties
- Printer setting
- Auto-shelve parameters
- Assigning group and common relays

Printers

All systems can be supplied with a local printer to provide and immediate record of alarm and return to normal states. As an option systems can be supplied suitable for connection via modem or Ethernet to remote printers. Configuration settings, summary and status reports can be printed on demand.

Software Options

With its advanced communications facility the System 9000TS is an ideal front-end to a screen based alarm management /recording system. RTK can provide Alarm Management Software and complete systems using industrialised computers and screens. These are developed in conjunction with the users to provide the clearest possible means of showing alarms, the priority of these alarms and exactly what to do in each alarm situation. These systems can also provide a means of displaying/storing all alarm and event history for analysis at a later date.

Timers

Delay timers can be incorporated into the System 9000TS on both the inputs and the outputs. This facility can avoid the possibility of nuisance alarms by setting an input time delay from 1ms to 65,000ms. Using this setting the alarm contact must be in alarm for a pre-determined minimum time before triggering the input circuitry whilst still maintaining an exact record of the time of the original event. For example, if an alarm occurs but it is dealt with and accepted, the remote telemetry system will not need to be notified.

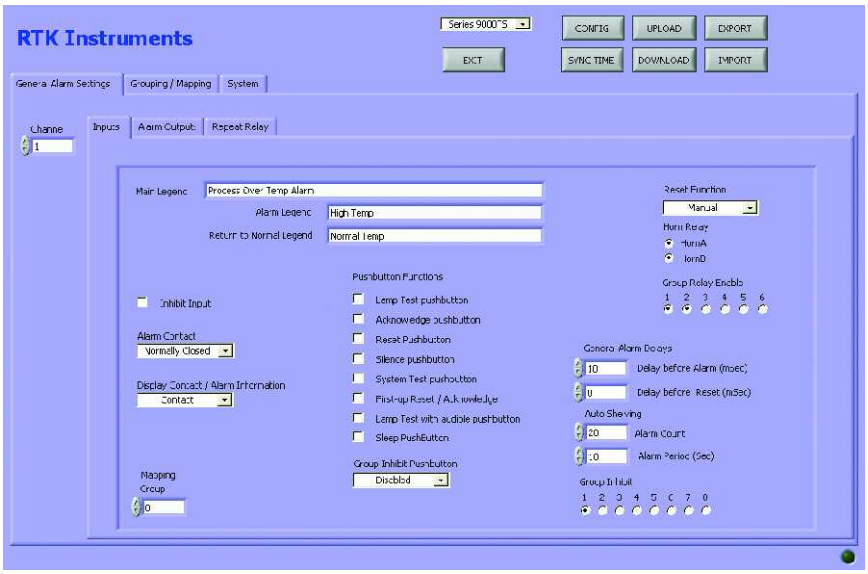
The Best of Both Worlds

Ideally, critical plant alarms should be hard wired to a dedicated Alarm and Event Recording System like the System 9000TS and data passed onto the DCS as a secondary function. This offers the best of both worlds in that the System 9000TS, which has been specially developed to offer high speed event capture and True First Out Discrimination, also provides the clearest possible indication of critical plant conditions.

The System 9000TS provides an independent, highly reliable, modular alarm system employing multiple redundant design features which should be used to complement centralised DCS platforms that have been primarily developed for control and monitoring.

Complete Systems

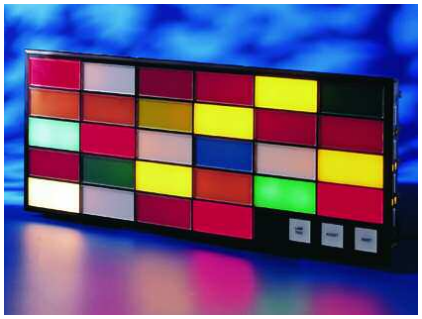
RTK can provide the System 9000TS mounted in a wall mounted or floor standing cabinet and provide all the necessary wiring to the displays, PSU's and terminals ready for final installation on site. These panels are quoted against each specific customer requirement; please contact the Sales Office for further details.



Displays

To complement the System 9000TS Alarm Annunciator, RTK Instruments offers a wide range of displays from simple lamp arrays to full mosaic mimic diagrams. Most of the displays are modular in design to enable RTK to match your exact needs, rather than compromising on the nearest available shape and size. The main display types are illustrated and described here; for more detailed information, refer to the separate display datasheet.

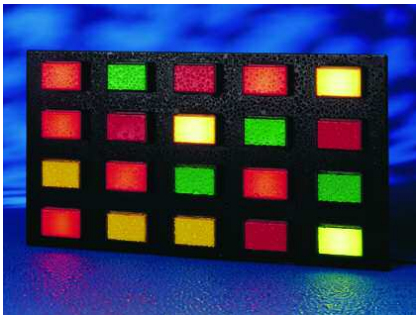
P725LO
Lamp-Only Modules
This display has been designed to match the Series 725 Alarm Annunciator – it will look identical when viewed from the front. It is available in exactly the same format as the Annunciator with three window sizes, six colours and a choice of lamp or LED illumination. This display is the best choice when LED illumination is required, offering the most competitive ultra-bright illumination. It is fitted with a 'Lamp Test' facility as standard.



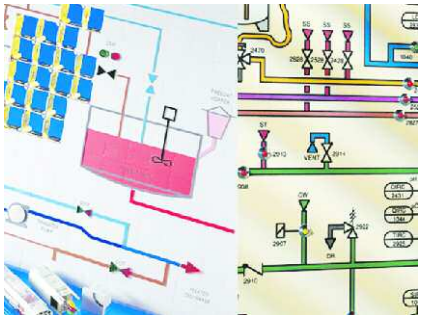
DF30 Display Facia
The DF30 display facia provides a flexible display panel for both LED or incandescent lamps. This display facia is totally modular allowing systems of almost any shape and size to be constructed. The basic lamp module is 30 x 30mm but these can be configured to give a range of window shapes and sizes by interconnecting multiple windows. This display can also have integral pushbuttons, keyswitches and audible devices. There is no limit to the number or position of these devices. All connections are by rear mounted screw terminals.

Hazardous Area Displays
When supplied through suitable certified interface devices, the System 9000TS can be used to drive a display facia in the hazardous area. The DF30IS is a backlit display certified as Ex II 1G, EEx ia IIC T4. The display gives a bright LED illuminated backlit display that matches the safe area versions.

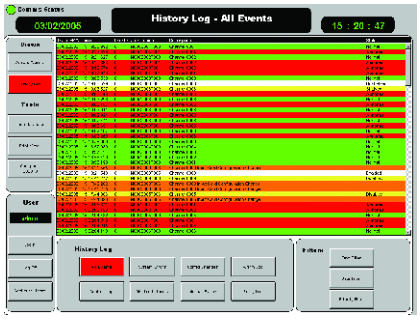
The L20 Intrinsically Safe Multiplexer can also be used to drive a hazardous area display using only two cables into the hazardous area.



IP65 Displays
Where protection from the environment is essential a range of displays sealed to IP65 can be provided. These custom-built units have bright LED display modules wired to rear mounted terminals. The completed assembly is mounted with a gasket to the panel door to maintain the sealing.



Mimic Displays
Mosaic tiled mimic systems can be driven by the System 9000TS to provide a flexible and informative overview display. The standard mosaic mimic uses a 24 or 25mm tile mounted on a strong aluminium honeycomb grid. Tiles are the moulded type for process mimics or alternatively screen-printed or engraved to form the required display drawing. A wide range of suitable lamps, switches, pushbuttons and displays can also be integrated into the finished mimic. On smaller projects and simpler display requirements a hard wearing, single piece mimic can also be provided.



Alarm Management Software
With its multi-redundant architecture and communications facility the System 9000TS is an ideal front-end to a screen based Alarm Management System. These can be set up in thousands of different ways to suit each individual alarm handling situation. Different display screens have already been developed and these building blocks would be used to provide a custom solution for each client. These systems could also incorporate touch screen displays, dual redundant servers and a range of industrial computers.

Advanced Annunciator Features

When combined with the Output Cards the S9000TS becomes a powerful Alarm Annunciator system, some of the commonly used alarm functions available are shown below

Repeat Relays
Each alarm way can have an individual repeat relay output in addition to any group relays configured. The relays can be set to be energised or de-energised and as N/O or N/C contact. The relay functions are also user configurable to follow the alarm logic or follow the input.

Output Relay Reflash
Each of the group relays can have a reflash facility enabled. This is where the group relay will change state for 500ms when another alarm within the group occurs. This allows a control room annunciator or monitoring system to indicate each occurence of a new alarm.

Multiplexer
To cut down on the costs of installing vast numbers of cables across large sites, the System 9000TS can be used as an economical multiplexer system, where all the input contacts are gathered by a single System 9000TS-TX Module and transmitted serially on 4 wires up to 1.2 km away to the receiving module, the System 9000TS-RX Module. The alarms can then be displayed on a display facia or within alarm management software packages.

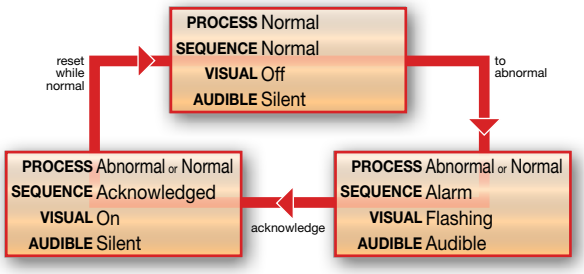
Sleep Mode
Useful in unmanned/not normally manned situations. Any input can be configured as a “sleep” input. When this input is switched on the drive outputs to the lamps and audibles are disabled. The annunciator will work exactly the same in all other respects; all alarms are monitored as standard and all repeat relays and communications function as normal. As soon as the system is switched out of the “sleep” mode, the display fascias will display all alarm information, complete with all first-up details.

First Up
In alarm annunciation applications, it is often essential to know which alarm occurred first. For this reason, the System 9000TS can be supplied with a flexible high resolution first-up facility as standard. Four different first-up sequences are provided to match the ISA standard S18-1 1979 (R 1984). Up to four separate first-up groups can be defined within the one system; each alarm way can be configured as being in one of these four groups.

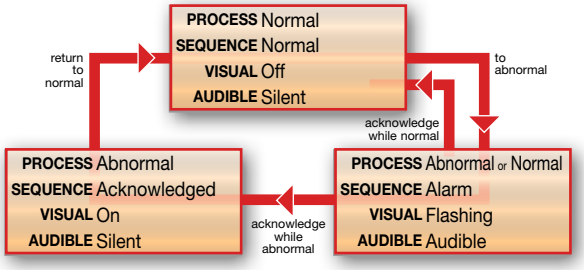
Sequence Tables

Each alarm channel can be configured to suit the operating sequence required as listed in the ISA publication *Annunciator Sequences and Specifications S18.1 1979 (R1985)*. Systems can be configured with different features on different alarm ways and there is no need to switch the power off. The diagram below shows the most commonly used sequences.

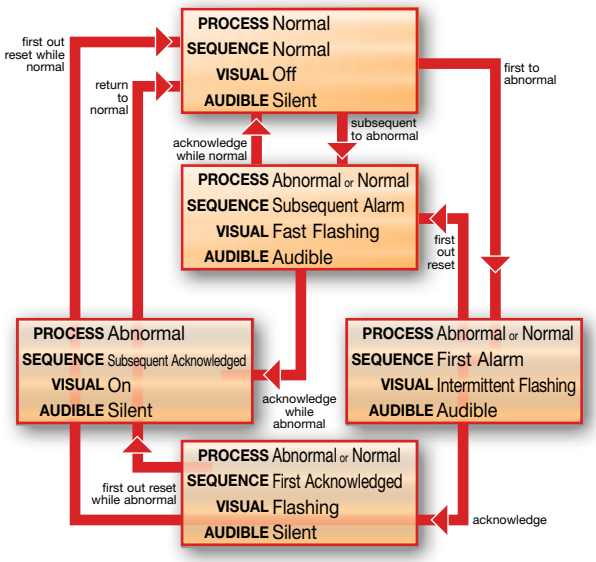
MANUAL RESET — Sequence Code M



AUTOMATIC RESET — Sequence Code A

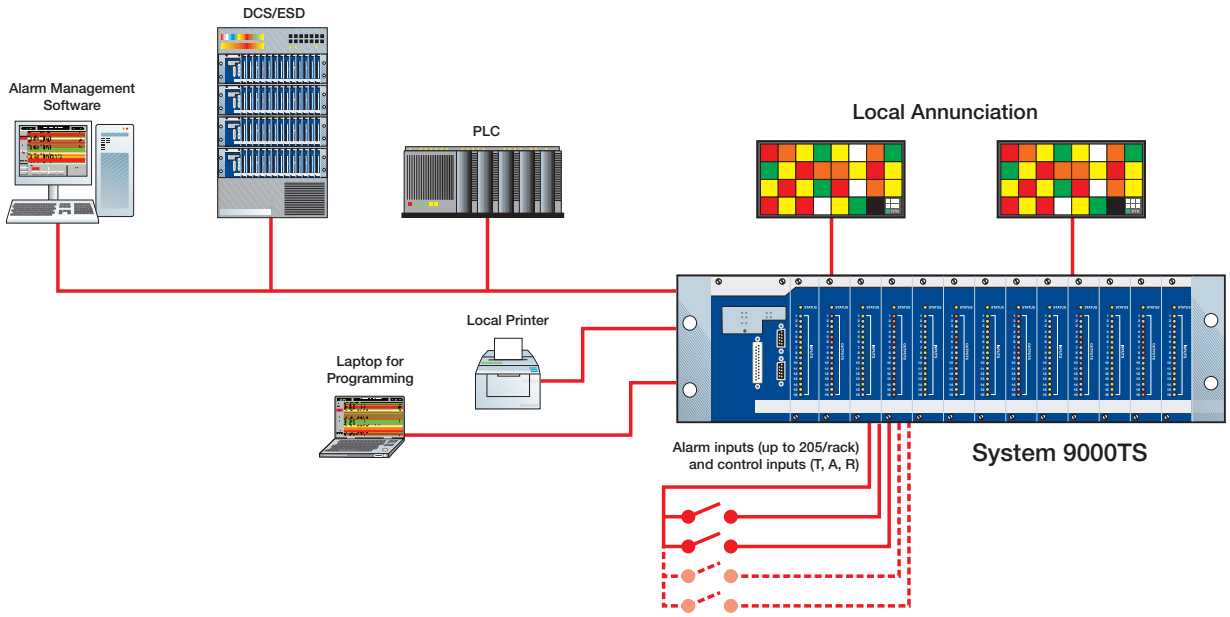


AUTOMATIC RESET FIRST OUT — Sequence F3A
WITH FIRST OUT FLASHING AND RESET PUSHBUTTON

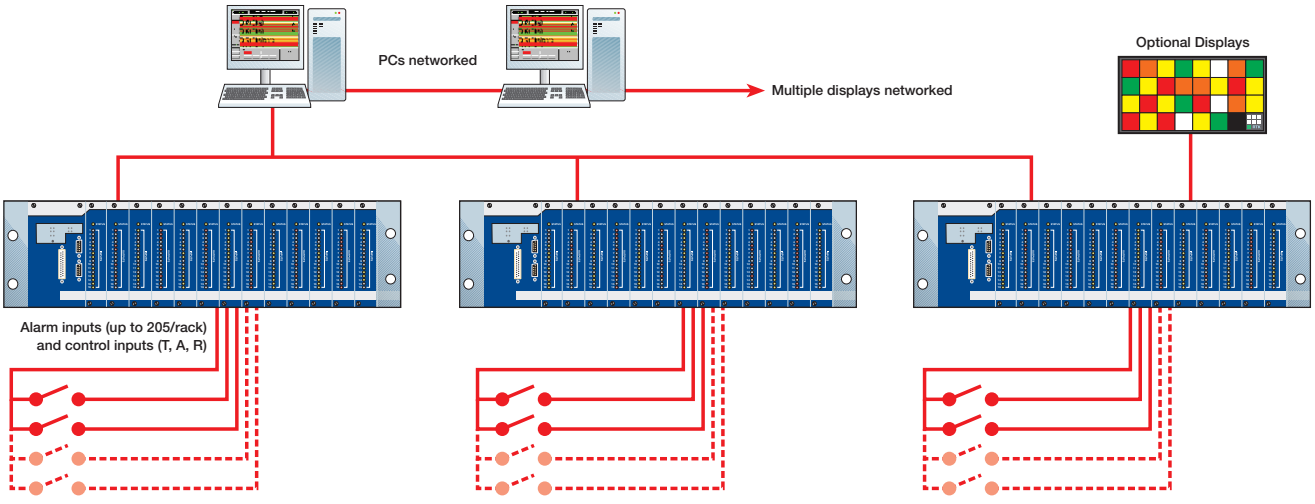


Installation and Mechanical Details

Standard System



Networked System

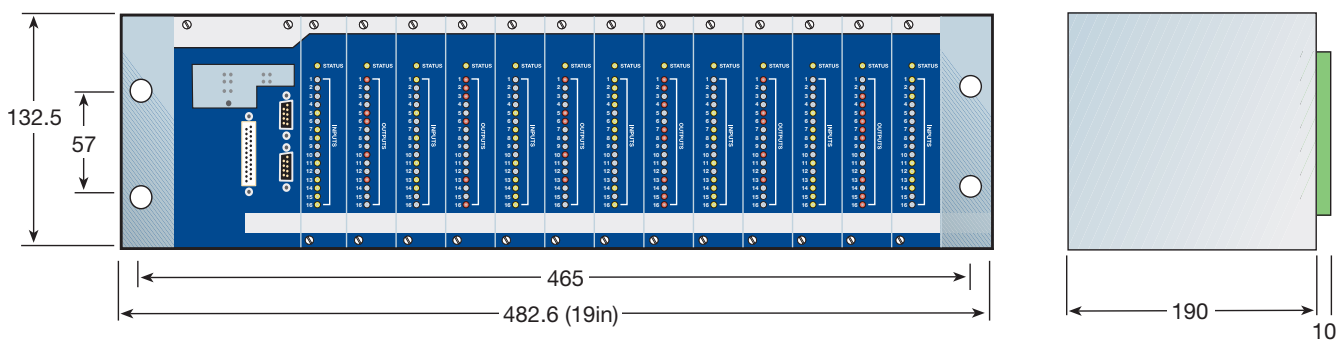


Remote mounted 9000TS to gather inputs

The System 9000TS is based on the standard eurorack, manufactured to IEC 297-3 (DIN 1494 Pt.5). The standard subrack size is 3U and 84E wide (19in).

This module will fit the Interface Card and up to 13 Input Cards. Larger systems can be supplied by interconnecting multiple racks. All signals are fully buffered between racks, so no signal deterioration will occur even on extremely large systems.

Thirteen module, full 19in rack



Technical Specification

Inputs

Alarm Contacts
All inputs are opto-isolated (isolation voltage 2.5kV). By using different wiring configurations, the same system can be used for both:

- Volt-free contacts which can have the operating mode configured using the Setup Card, to operate to alarm for contact open or to alarm for contact close.
- Voltage input from 24, 48, 110 or 250VAC/DC.

Alarm contact and cable resistance
N/C contact – series resistance of contact cables 20kΩ maximum.

N/O contact – parallel resistance of contact cables 200kΩ minimum.

Field contact voltage and current
The voltage for volt-free alarm contacts is fed from the unit at 24VDC at approximately 2mA.

To maintain complete isolation it is possible to use a separate PSU to feed all the alarm contacts.

Overall system resolution
1ms

First-up Discrimination
1ms

Alarm Clearance Discrimination
1ms

Control Inputs
Any input can be configured to one of the following control inputs:

- Lamp test
- Acknowledge
- Reset
- System test
- Silence
- First-up reset
- Sleep
- Horn Inhibit

Outputs

Lamp Drive (when Output Cards fitted)
Each output can drive up to 160mA at 24VDC, making it suitable for multi bulb displays or multiple repeat displays.

Standard Relays
Eight standard relays fitted on the Interface Card, these are configurable as system alarms such as watchdog, printer fault etc or group alarms.

Contact rating at 220VDC (250VAC) max, 125VDC @ 0.5A, 24VDC @ 2A, resistive. Selection of N/O or N/C contact by jumper link.

Repeat and Group Relays
Group relay card and individual repeat relays for each alarm way. Contact rating at 220VDC (250VAC) max, 125VDC @ 0.5A, 24VDC @ 2A, resistive.

Synchronisation
By pulse, IRIG-B or GPS signal

Printer Port
Standard parallel port

Serial Data
Event/alarm data can be transmitted using the serial communications port to other System 9000TS units, DCS systems, PLCs or computers.

Transmission – RS485C. Full duplex, 1 start bit, 7 data bits, 1 parity, 1 stop bit.

Baud Rate – up to 9600

Protocol – ASCII MODBUS and RTU

General

Supply Voltage
24VDC nominal (19–36VDC) Standard

A range of power supplies is available to convert from other AC or DC voltages.

Supply Current (mA)	**24V**
Quiescent: Interface Card	150
Quiescent: Input Card	50
Relay current/per relay	22

Add the current for the lamp drive to the totals of the above cards

EMC Compliance
Immunity to EN61000-6-2:2001
Emissions to EN61000-6-4:2001

LVD Compliance
The unit is designed and manufactured to safety specification
BS EN61010-1:1993

Environment
Operating temperature –20°C to +60°C
Storage temperature –20°C to +80°C
Humidity 0–95% RH, non-condensing

Mechanical Details
19in Rack
Standard 3U by 19in Eurorack to IEC 297-3 (DIN 1494 Pt.5)

Larger systems can be provided using multiple racks and interconnect cable.

Mounting
Industry standard 19" racks with rear terminal access

Assembly
All cards plug in to a standard pre-tested motherboard using DIN41612 connectors. This allows simple system expansion of system size at a later date.

Connections
Plug and socket terminals of the rising clamp type, maximum cable size 2.5mm^2. Quick disconnect terminals with locking screws available as an option.

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