The Life of Energy

SYNERGY
SYSTEMS & SOLUTIONS

HUSKY™

INDEX

HUSKY™ RTU 6049-E70 is Synergy Systems & Solutions' latest offering for data acquisition and control solutions in energy generation, transportation, and distribution systems. RTU 6049-E70 has a large installation base of more than 500 locations in Railway traction monitoring, EHV sub-stations, solar and wind farms, oil & gas pipelines. The RTU design incorporates latest technology to achieve high-end performance and reliability.

The in-house knowledge and expertise of legacy products positions HUSKY as an ideal choice for retrofit applications. HUSKY provides an optimal cost-effective solution in upgrading legacy systems to meet current and future requirements.

What is in a name ?

Husky is a breed of dogs normally found in the arctic region, and is used for driving sledges. It is a friendly, strong, powerful, reliable breed that is well adapted to the harsh environment of the arctic. HUSKY RTU imbibes these qualities, hence the name.

PRODUCT HIGHLIGHTS

❍ TELEMETRY STATION, DATA CONCENTRATOR, GATEWAY, PLC FUNCTIONALITY

❍ SUITABLE FOR MEDIUM TO HIGH I/O COUNT APPLICATIONS

❍ DISTRIBUTED PROCESSING WITH "LOCAL" INTELLIGENCE

❍ SUPPORTS "ACROSS-THE-PLANT" DISTRIBUTED I/O

❍ HIGH SPEED OPTICAL I/O BUS FOR DISTRIBUTED I/O

❍ IEC 61850 READY – INTEGRATION WITH STATION BUS

❍ WIDE VARIETY OF INDUSTRY STANDARD AND PROPRIETARY PROTOCOLS

❍ FAULT-TOLERANT REDUNDANCY AT MULTIPLE LEVELS

❍ LOCAL FAULT DIAGNOSTICS ON ALL MODULES

❍ FIBRE OPTIC ETHERNET FOR OPERATION IN ELECTRICALLY HARSH ENVIRONMENTS

❍ EXPANDABLE COMMUNICATION INTERFACES - SERIAL AND ETHERNET

❍ IEC 61131 LOGIC PROGRAMMING

❍ UNIFIED CONFIGURATION, PROGRAMMING, AND DIAGNOSTIC SOFTWARE – HUSKY STUDIO

❍ WEB-INTERFACE FOR MONITORING OF RTU FUNCTIONS

HUSKY RTU 6049-E70 has been designed to address data acquisition and control requirements of various industry segments. The RTU follows a scalable architecture that's expandable while maintaining flexibility and adaptability to suit different application scenarios.

The RTU can be used as a slave/server for transmission of collected data to remote control centres, as well as a master/client for use in data concentrator applications.
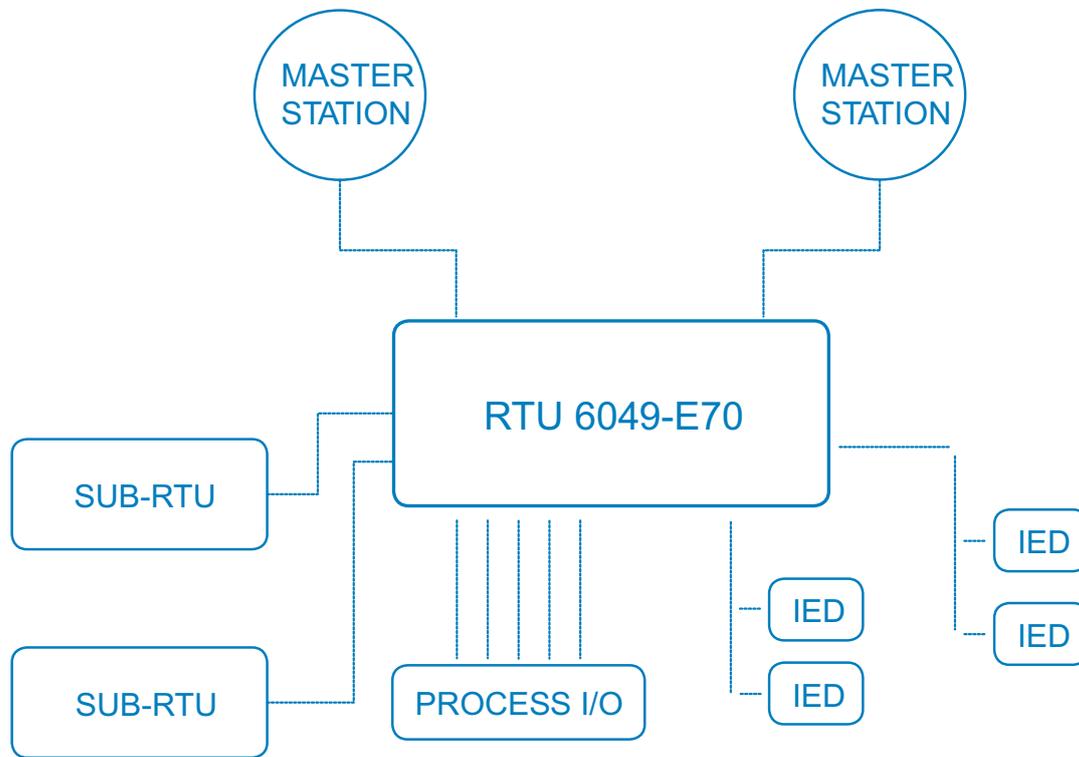
RTU Architecture

RTU 6049-E70 consists of the following components:
- Processor Modules (with suitable chassis backplane)
- Power Supply Modules
- Input/Output Modules
- Specialty Communication Modules
- Real-time operating system
- Protocol stacks for comm. with control centres & IEDs

The RTU equipment is designed for mounting in 4U-high sub-racks. Choice of I/O modules with varying densities, and chassis backplanes are available for optimal configuration of different application needs. Full-size backplane (19"-subrack) supports 16 I/O modules, while smaller backplanes accommodating 5 I/O slots are also available.

The RTU can be configured to suit I/O requirements of medium to high range applications, through addition of I/O modules and expansion racks. All racks have generic I/O slots, which can be used for any of the supported I/O modules. This architecture aids in flexibility of system design while keeping costs to the optimum.

The core of the RTU design is the processor (CPU) module which executes all the software functions of the RTU. The software architecture is based on a real-time operating system for execution of time-critical tasks in a deterministic manner. Further, using hardware-assisted features like direct memory access (DMA), some of the time-consuming tasks are offloaded by the CPU to its peripherals.
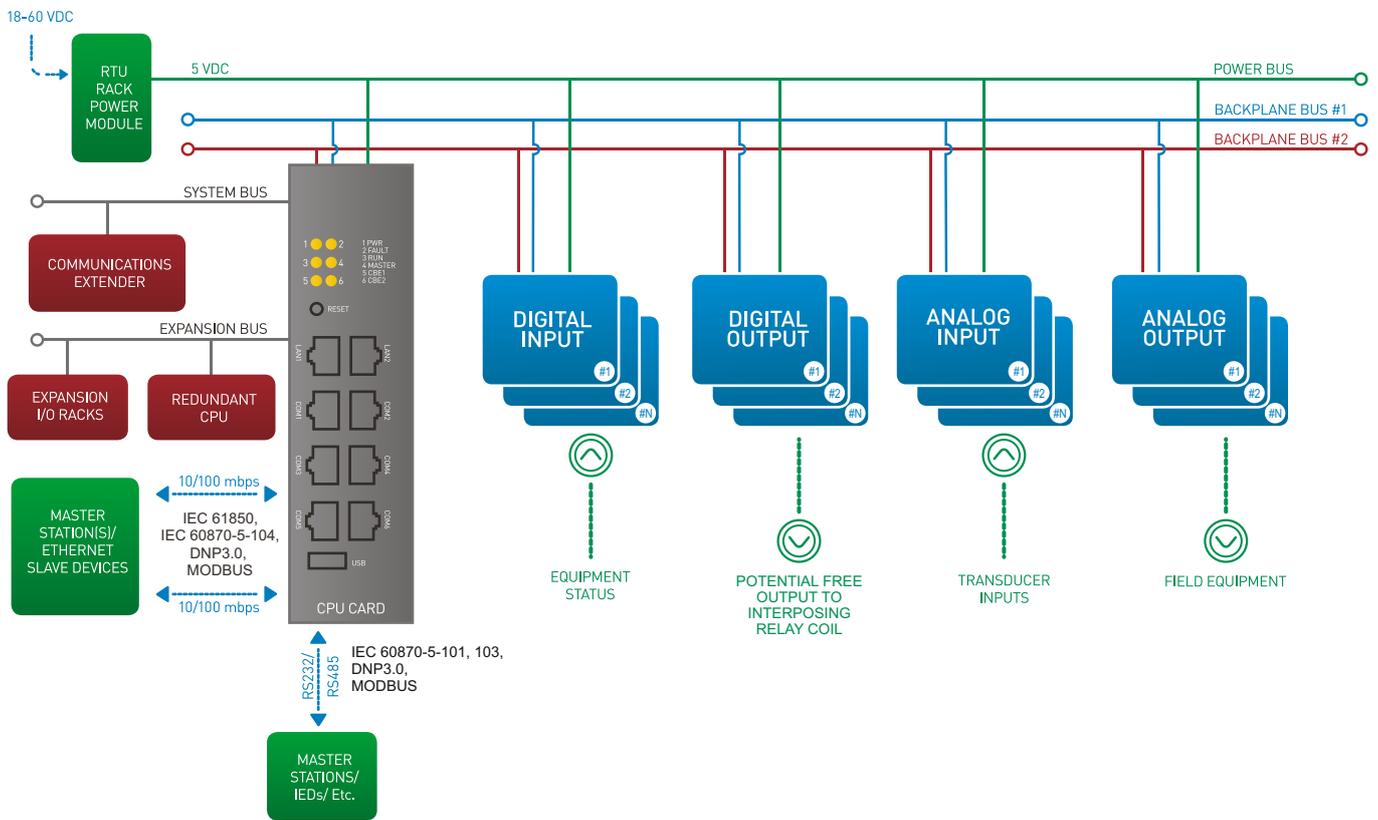
The RTU System Bus allows expansion of the RTU communication capabilities. The system bus consists of a 16-bit high speed parallel bus and high speed serial bus. These busses allows installation of communication extender modules or specialty modules, which provide additional serial/Ethernet interfaces and/or specific function like LON interfaces.

SYSTEM DESIGN CAPACITY

Maximum Wired Tags	Digital Inputs : 2048 Digital Outputs : 1024 Analog Inputs : 1024 Analog Outputs : 512 Counters : 512
Maximum Virtual Tags	Boolean : 4096 16-bit Integer : 2048 32-bit Integer : 2048 32-bit Float : 2048 Timers : 128
Maximum CXM Modules	4
Maximum I/O Racks	8
Maximum Devices	32 devices per serial port 256 devices maximum
Maximum Communication Tasks	48

GENERAL OPERATING PARAMETERS

Nominal Input Voltage	24/48/110VDC
Relative Humidity	95%
Operating Temperature (°C)	0 – 70

19" SUB-RACK CHASSIS

POWER SUPPLY UNIT
WIDE INPUT 18-60V DC
30W-60W
HIGH EFFICIENCY
FAIL SAFE, REDUNDANT
ISOLATED, REGULATED

DIGITAL OUTPUT
POTENTIAL FREE RELAY CONTACTS
PULSED, LATCHED OUTPUT
SELECT-BEFORE-EXECUTE (SBE)
1000V ISOLATION

DC ANALOG INPUT
+/-10VDC, 0-20mA INPUT
16 BIT RESOLUTION
0.1% ACCURACY
SELF CALIBRATING
2500V ISOLATION

HUSKY
RTU 6049-E70

SYNERGY
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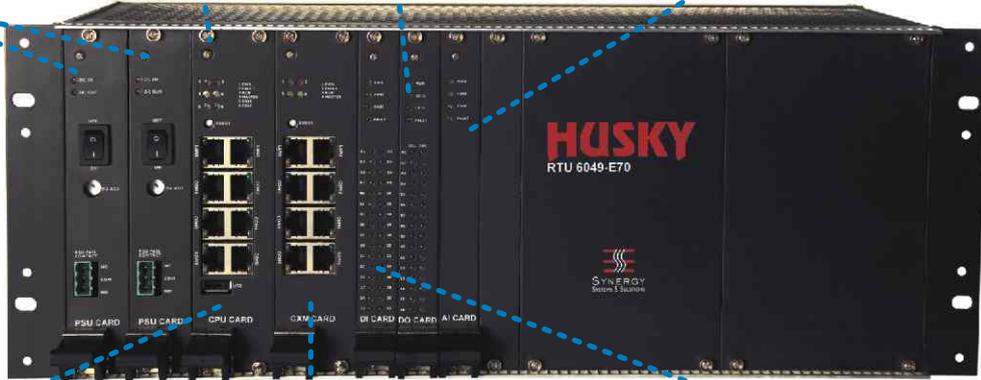
CPU E70
32-BIT PROCESSOR
MULTIPLE SERIAL PORTS
ON-BOARD DATA STORAGE
CPU REDUNDANCY
INDUSTRIAL GRADE

COMM. EXTENDER MODULE
ADDITIONAL COMMUNICATION PORTS FOR CPU
PROVIDES ETHERNET/SERIAL COMMS.
SUPPORTS ALL PROTOCOLS OF CPU
ISOLATED INTERFACES

DIGITAL INPUT
24VDC, 48VDC, 110VDC INPUTS
MULTIPLE GROUPS
1MS SEQUENCE-OF-EVENT RECORDING
3700V ISOLATION
GROUP-TO-GROUP ISOLATION

PLUGGABLE PROCESS I/O CONNECTIONS

EXPANSION BUS CONNECTIONS
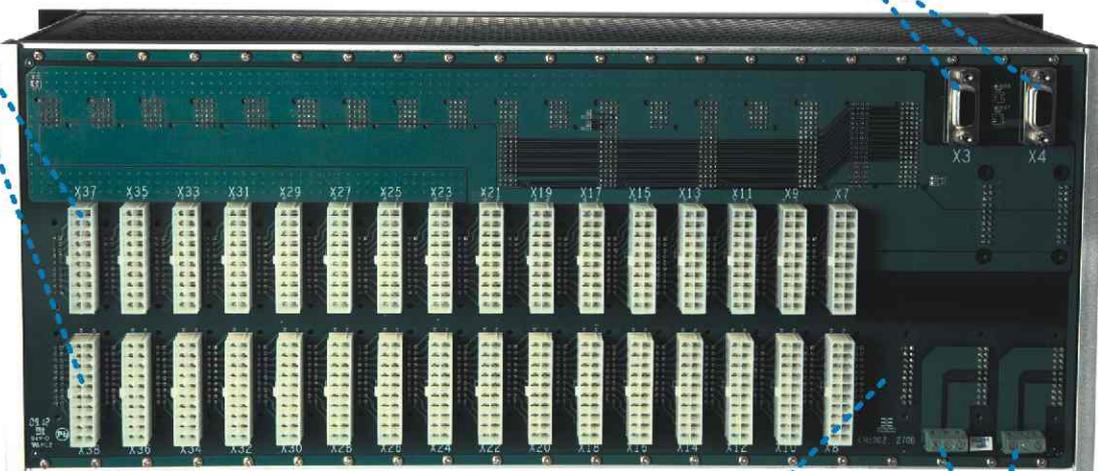
1PPS/ 1PPM TIME SYNC INPUT

DUAL REDUNDANT POWER INPUTS

I/O Architecture

The I/O modules provide the field interface for the RTU for monitoring and control of process signals. These modules can be inserted in the 4U sub-rack at any of the designated I/O slots. Through the use of expansion racks more I/Os can be added to the RTU. A single CPU processes all the I/Os of the racks.

The main rack of the RTU consists of the processor module, which interfaces with the local rack I/O as well as the expansion rack I/O over high-speed digital links. The expansion racks are connected to the main rack over a dual-redundant bus. Each expansion rack is fitted with an I/O scanner module, which performs its local rack I/O scanning, and handles communications with the CPU over the I/O expansion bus. The I/O modules exchange I/O data, Sequence of Events (SoE), and diagnostic/configuration information of the modules/channels. All modules are synchronized with the CPU clock over the I/O bus.

Local I/O Bus – CAN 2.0

The local I/O bus is based on the popular and rugged CAN bus. It has been widely used in industrial control and automotive industry. CAN bus provides high immunity to external noises present in an industrial environment, and has built-in error handling and fault confinement features. Therefore failure or malfunction of an I/O module does not cause failure of the entire bus. Using the priority-based messaging feature of CAN bus data like I/O status are transferred to the CPU on higher priority. The local I/O bus operates at 1Mbps.

Expansion I/O Bus – ARCNet

The I/O expansion bus is based on the industry-standard ARCNet protocol. ARCNet is a deterministic, reliable, token ring bus with a proven track record. A 16-bit CRC is used to detect errors on the bus. A dedicated communications controller (FPGA-based) manages the ARCNet communications, including redundant link management.

The expansion bus can operate at a maximum speed of 10Mbps. Using the time-deterministic nature of the ARCNet protocol, all I/O is scanned by the CPU within a fixed amount of time, called the RTU I/O scan cycle. Typical I/O scan rates achieved by the RTU is 10 msecs.

Remote I/O can be connected to the RTU using the expansion bus. For distances up to 15m, the bus can be operated at the maximum speed. For longer distances the bus can be operated at a reduced speed of 2.5Mbps. For plant wide distribution of I/O, an optical fibre based high speed, 10 Mbps network is also supported.

Expansion Racks

Expansion I/O racks are installed with an I/O scanner module which collects data from the rack over the local I/O bus and transfers the processed data over the expansion bus to the CPU module. Multiple expansion racks can be daisy chained to accommodate high I/O requirements. The RTU supports a total of eight (8) expansion racks.

I/O Module Architecture

All I/O modules are designed with an onboard dedicated 32-bit microcontroller. This aids in faster I/O scanning and maintaining of time-stamps as close to the field interface as possible. Further, I/O module specific intelligence is offloaded by the CPU to these microcontrollers, thereby alleviating the load on the main processor.

While interfacing with field signals, all I/O modules provide a minimum of 1kV isolation between the field and the internal logic. Further, all field signals that enter the I/O modules are protected against transients. Module-specific input protection, if any, is also provided to prevent damage to the module in case of inadvertent inputs or wrong wiring.

Hot-swap feature of the I/O modules allows field maintenance and troubleshooting without affecting overall system downtime.

Features common to all of the I/O modules of the RTU 6049-E70 :

- Dual redundant high speed I/O bus for I/O exchange with CPU
- Onboard 32-bit microcontroller
- Hot swap capability
- Isolation between field and logic

- These I/O modules can be inserted into any of the backplane I/O slots
- EMI/EMC Compliant
- Local fault diagnosis
- Surge Protection

Process Connections

Connections to the process I/O are done through two 20-pin (2x10) Molex connectors (connectors C & D) on the rear of the backplane for each slot. These connectors (which are pluggable type) accept cables of 17-23 AWG. The termination details of these connectors are detailed in the respective I/O module description. The two Molex connectors are named 'C' and 'D', with the pins in each connector named A1-A10, B1-B10.
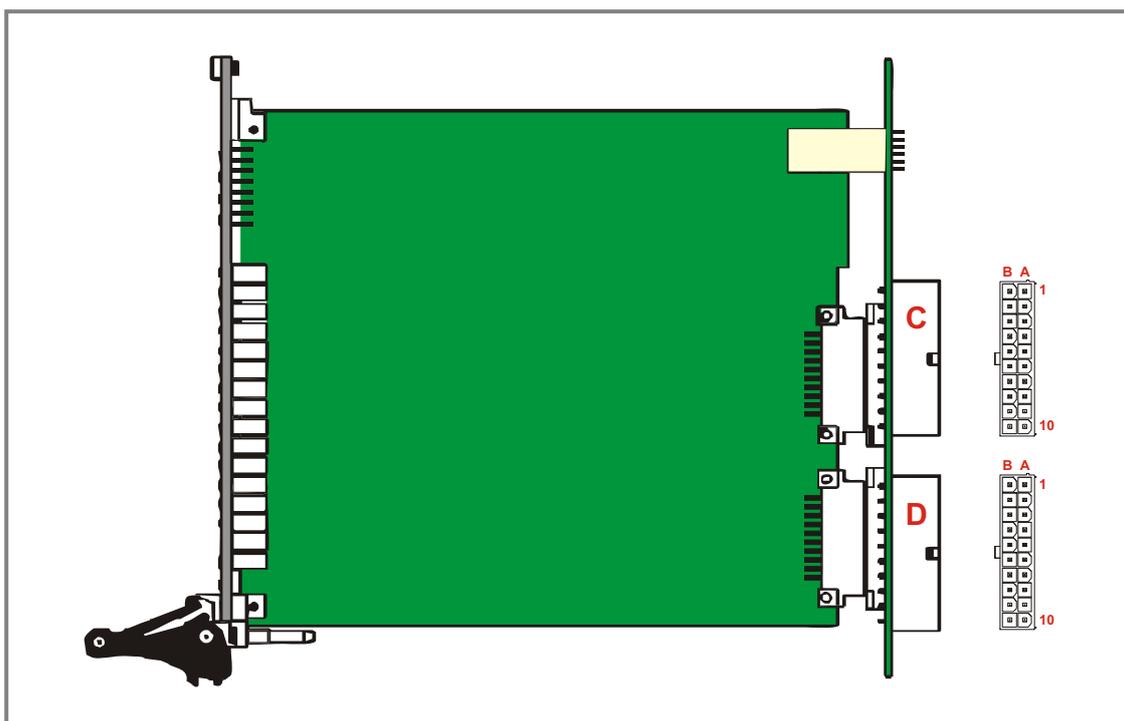
Digital Inputs

The digital input module is a multi-functional module that provides more features than basic reporting of binary states. The digital input module combines the functionality of (Sequence of Events) SoE module, pulse counter and BCD. Digital input module has an onboard processor that timestamps the data precisely at the occurrence of the event. This eliminates the requirement of special SoE modules for capturing events with 1 msec resolution. Each channel is individually configurable with Input Filter and "Data Inversion Reporting". Also single chatter filter can be specified which is applicable to module as whole.

The RTU provides these functions for digital input status points :

❍   Scanning of digital points at 1ms resolution

❍   Single-bit and double-bit indications

❍   Generation of sequence of events

❍   Input filtering for filtering spurious events due to contact bounce

❍   Anti-chatter algorithm to suppress chattering inputs

❍   Pulse counting up to 1kHz

❍   Binary Coded Decimal (BCD) inputs

Digital input module also provides facility to configure channels as pulse counters. Pulse counting of up-to 1kHz is supported by the module. Channels can be configured for Form-A, Form-B or Form-C type pulses. Applications like Energy Accumulation, that requires counting of pulses provided by Energy Meter, does not require any special module thereby providing more value for the investment.

Digital input module can also be configured to combine multiple channels and decode data in the form of BCD (Binary Coded Decimal). Group of 4 channels can be configured for single digit BCD. Multiple groups can be combined together to form BCD up-to 8 digits. Multiple groups can be configured independently to generate multiple combinations to suit the application requirement.
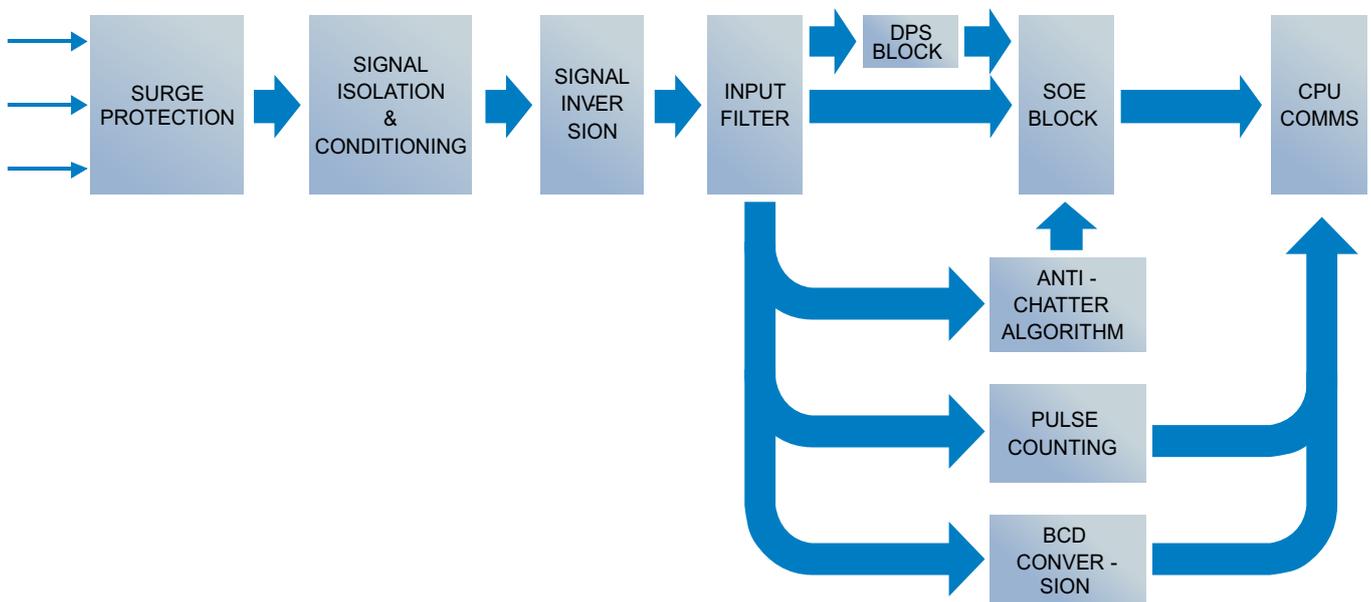
DIGITAL OUTPUTS

Digital outputs are typically used to control process equipment through generation of ON/OFF commands. Control commands can be received over a communication protocol or through programmed user-logics.

The following functions are supported by the RTU for digital outputs :

❏ Latched outputs

❏ Pulsed outputs with user-configurable pulse lengths

❏ Option for generation of pulse-train outputs

❏ Select-before-execute (SBE) control commands

❏ Single-bit and double-bit commands

Command requests received by the RTU are directed to the corresponding digital output module by the CPU. Command requests contain apart from the command value, a qualifier of command (QOC), which specifies the type of command and other command-specific parameters. HUSKY RTU follows IEC 870-5 conventions for specification of QOC. The QOC field is automatically derived by the command receiving task based on the protocol-specific commands through which it received the command, and passes it on to the command execution task.

Pulsed and latched outputs are classified as direct-operate commands, which require a single command request to activate the output channel. Select-before-Execute (SBE) outputs are a different class of pulsed outputs that require a two step operation to activate the output channel. The two steps are 'select' and 'execute'.

For achieving this two-step operation, the digital output modules feature one relay per output channel, and one master relay for a group of channels. E.g., E70-DOA-001 has 16 channels in two groups of 8. Therefore there are 16 relays, one for each channel, plus two master relays one for each group.

Two consecutive channels of the digital output module can be combined together to form a double-bit command. In case of double-bit commands only one of the two channels can be active at a time.

## Select-before-Execute (SBE) Function

Digital output modules that provide the SBE function, have extensive on-board diagnostics to ensure proper and correct operation of the output channel. Each command request is first validated against the user configuration to determine the acceptability of the request. When a select command request is received, the module performs a hardware check to ensure that no other output channel is already activated. A feedback circuit on the module monitors the on-board relay contacts so that only the correct output channel is activated during a select request. A negative confirmation is sent if either relay fails to operate, or any other channel's relay is already operated. A positive confirmation is sent when no validation/feedback error occurs.

When an execute command request is received, the module validates that the specified channel is already selected, i.e., its corresponding relay output is activated. After successful validation of the execute request, the master relay (also called as execute relay) is turned on, which then completes the circuit towards the field devices. The master relay's contacts are also monitored and a positive confirmation is sent only when the execute feedback circuit receives proper input from the master relay contacts.

Direct Operate Function

In case of direct operate mode, each channel can be configured as pulse or latch providing mixed functionality to suit the application requirements. Single module can be used in applications requiring pulsed outputs for field equipments and latched outputs for local MIMIC/annunciation displays. Duration of pulsed outputs can be controlled either through user configuration or by a master station command parameter. A channel configured in Pulse mode can be configured to generate pulse train with user-specified pulse duty cycle.
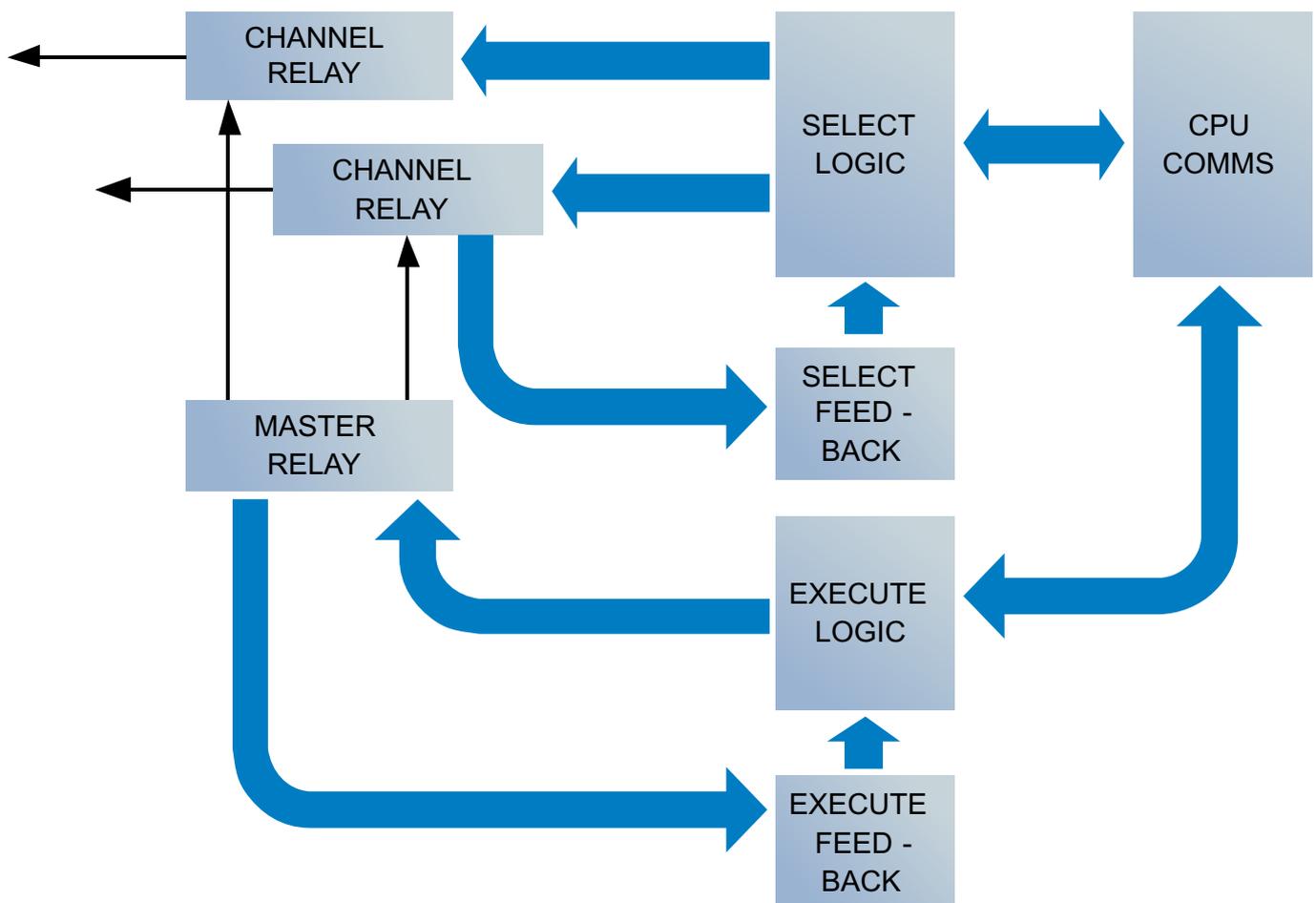
ANALOG INPUTS

The following functions are supported by the RTU for analog inputs :

❍   16-bit resolution inclusive of 1-sign bit for hardwired analog values

❍   Multiple input ranges for voltage and current signals

❍   Under/over-range monitoring

❍   Live-zero monitoring

❍   Rate-of-change monitoring with alarm generation

❍   Exception reporting based on user-specified deadband
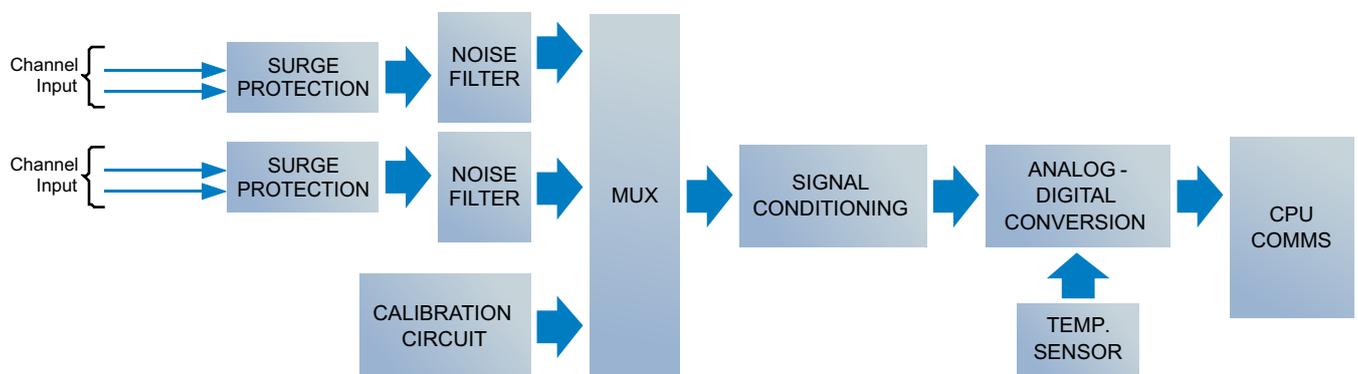
Analog Input module provides different input ranges to suit most types of applications. Each channel is individually configurable for voltage and current (via hardware jumpers) and each channel can be further configured for different input ranges to suit the application requirement. Input ranges are configurable from Husky Studio.

The module features two precision low-temperature drift reference circuits which are used for automatic self-calibration of the analog front-end. Variations in performance of the analog circuitry due to temperature changes are thus compensated by the module, thereby delivering the guaranteed accuracy of measurements. A calibration out of range alarm is also provided by the module, when the variations in readings are beyond the limits of compensation.

All channels also feature 50/60Hz noise rejection for eliminating errors due to AC interference, etc. This feature can be enabled/disabled for the module by the user.

Exception Reporting

Analog input values are periodically scanned by the CPU and the internal memory database updated. These values are typically reported to master stations on cyclic/on-demand basis. However, certain applications demand exception (spontaneous) reporting of values based on change in value, alarm limit violation, etc. A channel can be enabled for exception reporting, by enabling the SoE feature of that channel. The condition for generating the SoE is derived based on user-inputs described later in this section. The SoE generated includes a time-stamp indicating the time of generation of the exception report.

Deadbands

Deadband is defined on per channel basis, in percentage terms of the positive side maximum value (i.e., value at 32767 counts). The deadband specified is the amount of minimum change by which the input must vary in either increasing or decreasing direction from the previous value that was reported by exception.

Deadband Around Zero

Deadband around zero is used to force the value of the input to zero when the actual input is within a specified limit near zero. This parameter is specified in percentage terms of the positive side maximum value (i.e., value at 32767 counts).

Alarm Function

Analog values can also be reported by exception based on high/low alarm conditions. The alarm limits are specified in percentage terms of the positive side maximum value (i.e., value at 32767 counts). A non-zero value on the high/low alarm limit enables the alarm monitoring function on that channel. When the input value goes below the low alarm limit, an exception report is generated. Similarly, when the input value goes above the high alarm limit, an exception report is generated.

To prevent frequent generation of exception reports, when the input value is hovering around an alarm limit, the deadband (Section 4.3.3) parameter is used to provide alarm hysteresis function. Once an exception report for an alarm is generated, a new exception report is not generated unless the value has changed from previous alarm value with a difference greater than the specified deadband.

Analog Outputs

Analog output modules provide selectable voltage/current outputs for controlling process equipment. Each output channel is individually selectable between voltage and current outputs, and can be programmed for different output ranges.

Each output is individually isolated and surge protected and driven by from a dedicated digital-analog converter (DAC). The dedicated DAC maintains the output at the correct value, without the need of any sample-hold mechanisms as used in multiplexer-based architectures, which require periodic refresh of the value by the hardware. The analog output module is powered from an external 24VDC power supply. Loss of field power to the module is monitored and reported by the module diagnostics function to the CPU.

For current outputs, open-loop and loop-short sensing is provided, and is reported to the CPU through channel fault indications. Open loop sensing allows for live-zero monitoring function. The output channel is declared faulty on detecting an open-loop or short-circuit. Current loop voltage (up to 24VDC) is provided externally to the module.

As an optional feature analog output module supports the functionality of reading the output values, for monitoring the outputs.
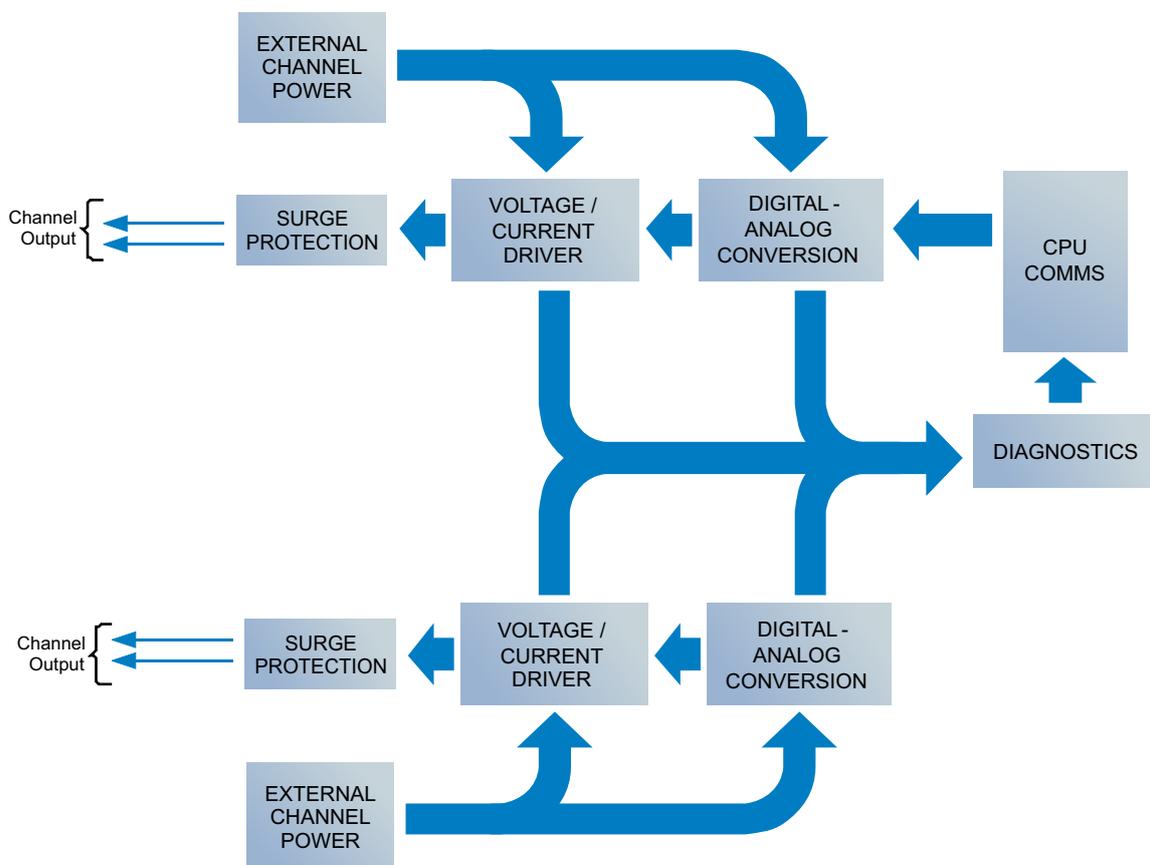
Time Synchronization

The RTU's real-time clock (RTC) can be time synchronized from an external master clock like a GPS receiver over SNTP or serial-based ASCII (E.g., NMEA 0183) protocols. The RTU also supports time synchronization messages provided by SCADA protocols like IEC 870-5, DNP3.0, etc. Slave devices connected to the RTU can be time synchronized by the RTU using its RTC as the time base.

HUSKY RTU supports up to eight time sources with various input possibilities including the above mentioned sources as well as IEEE 1588 master clock, and 1PPS/PPM pulse inputs. The time sources can be assigned different priorities wherein, if a higher priority clock is not present, then the RTU uses a lower priority clock to synchronize itself. Status of individual master clocks are available under system variables, which can be monitored over any master station protocol or using HUSKY Studio. Receiver-specific options like time zone offset, poll interval, and clock timeout are configurable.

The RTC operates using a temperature controlled crystal oscillator (TCXO) which enables the RTU to maintain a time accuracy of ±1ppm. The RTU clock data is stored in battery-backed non-volatile memory.
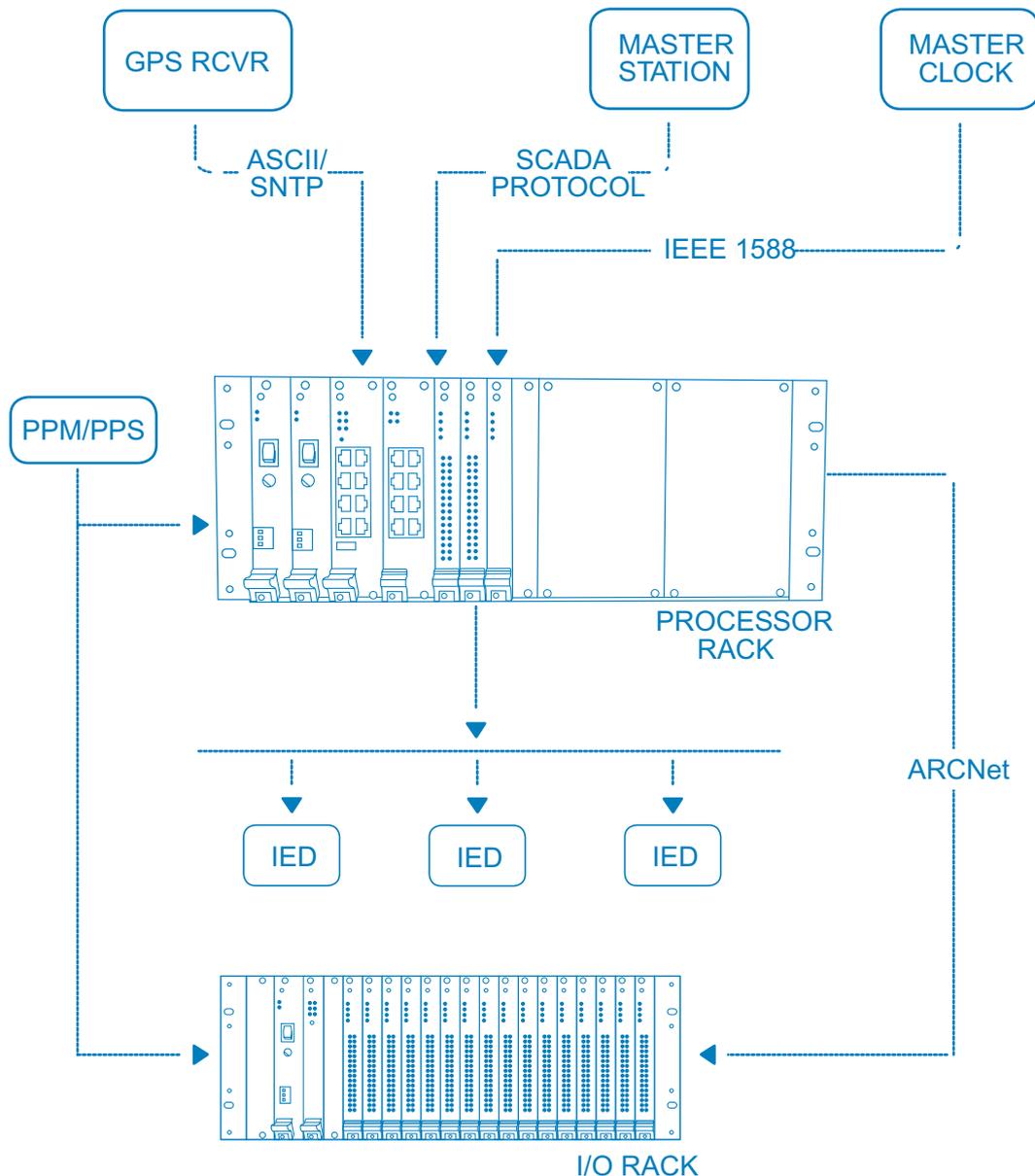
Software Architecture

Real-Time Operating System

HUSKY RTUs employ a real-time operating system (RTOS) to deliver real-time response required by process control and automation industry.

Distinguishing features of RTOS include powerful pre-emptive real-time performance with optimized context switching to deliver real-time guaranteed response times, required for process control systems. With features like guaranteed interrupt service latency times, small size, highly configurable core and direct access to CPU core makes it an ideal choice of RTOS for HUSKY. A configurable RTOS core ensures that only required components are built into the RTU kernel thereby increasing system security, reliability and performance. With its message queuing system, it allows multiple RTU components to exchange information in a true real-time environment.

With an embedded TCP/IP stack and optimized file system, the RTU provides convenience of a modern PLC and traditional RTU in a single package.

Non-volatile Memory

RTU 6049-E70 supports two types of non-volatile memories - battery-backed RAM and NAND flash.

The battery-backed RAM is used for storing real-time clock information, retentive memory tags, and events collected by the RTU. Events acquired by the RTU are therefore not lost in case of power failure, and transmitted to the master stations on restoration of power. A supervisory circuit protects the RAM contents from being corrupted during power off conditions. A battery low alarm is provided for monitoring the battery status.

Flash memory is used by the RTU to store application image, user configuration, programmed logics, log files, and other file-like data (Disturbance Records, Metering Profiles, etc.) it may acquire from other devices. Special Flash file system with wear-levelling algorithm provides optimized use of the flash memory and speeds up the flash access prolonging the usable life of the flash device.

For special applications, higher capacity flash memory can be provided.

I/O Memory Architecture

The I/O memory consists of two blocks of memories, one for volatile variables, and other for non-volatile/retentive variables. From an application point of view, the memory is represented as one contiguous block of memory. However, internally it is split into two different blocks for volatile and sized according to different memory types.

I/O Memory

BV
DPV
I16V
...
DO
DI

NVRAM

PROCESSOR RAM
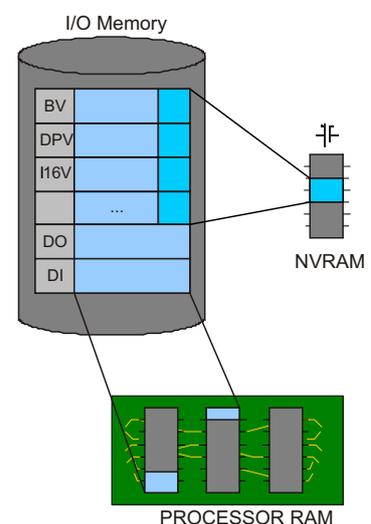
Memory Types

Memory Type	Description	Capacity
%DI – Digital Input	Used for physically connected 1-bit binary input signals	4096
%DPS – Double-point Status	Used for physically connected 2-bit binary input signals	4096
%AI – Analog Input	Used for physically connected analog input signals (16-bit signed value)	1024
%CI – Counter Input	Used for physically acquired counter/accumulator signals	512
%DO – Digital Output	Used for physically connected 1-bit binary output signals	2048
%DPC – Double-point Control	Used for physically connected 2-bit binary output signals	2048
%AO – Analog Output	Used for physically connected analog output signals (16-bit signed value)	512
%BV – Boolean Variable	Memory-based boolean variables used for logics, communication task acquisition	4096
%DPV – 2-bit Status Variable	Memory-based 2-bit variables used for logics, communication task acquisition	4096
%I16V – Integer Variable	Memory-based 16-bit signed variables used for logics, communication task acquisition	16384
%I32V – Integer Variable	Memory-based 32-bit signed variables used for logics, communication task acquisition	10240
%F32V – Floating-point Variable	Memory-based 32-bit floating point variables used for logics, communication task acquisition	10240
%BS – Boolean Status	Boolean status variables used by the system to indicate various system status	4096
%I32S – Integer Status	32-bit integer status variables used by the system to indicate various system status	2048

I/O Quality Flags

All memory types support a basic set of quality flags in addition to current value. These flags can be used for reporting the status of the value over protocols supporting transfer of such information.

The following quality flags are supported by the RTU :

❍ Topical – This flag when set indicates that the value is current / updated. When this flag is not set the value is not topical. This could be due to loss of connectivity between the processor unit and source of the value (e.g., I/O module).

❍ Invalid – This flag when set indicates that the value is not within the specified valid limits. E.g., when a 4-20ma input goes below 4mA.

❍ Blocked – This flag when set indicates that the value has been blocked for acquisition from its source by the user.

❍ Substituted – This flag when set indicates that the current value is a user substituted value, and is not from the actual source.

❍ Chatter – This flag is provided by digital input modules that support chatter filtering. When this flag is set, it indicates that the input channel is in chattering state.

Software Architecture Diagram
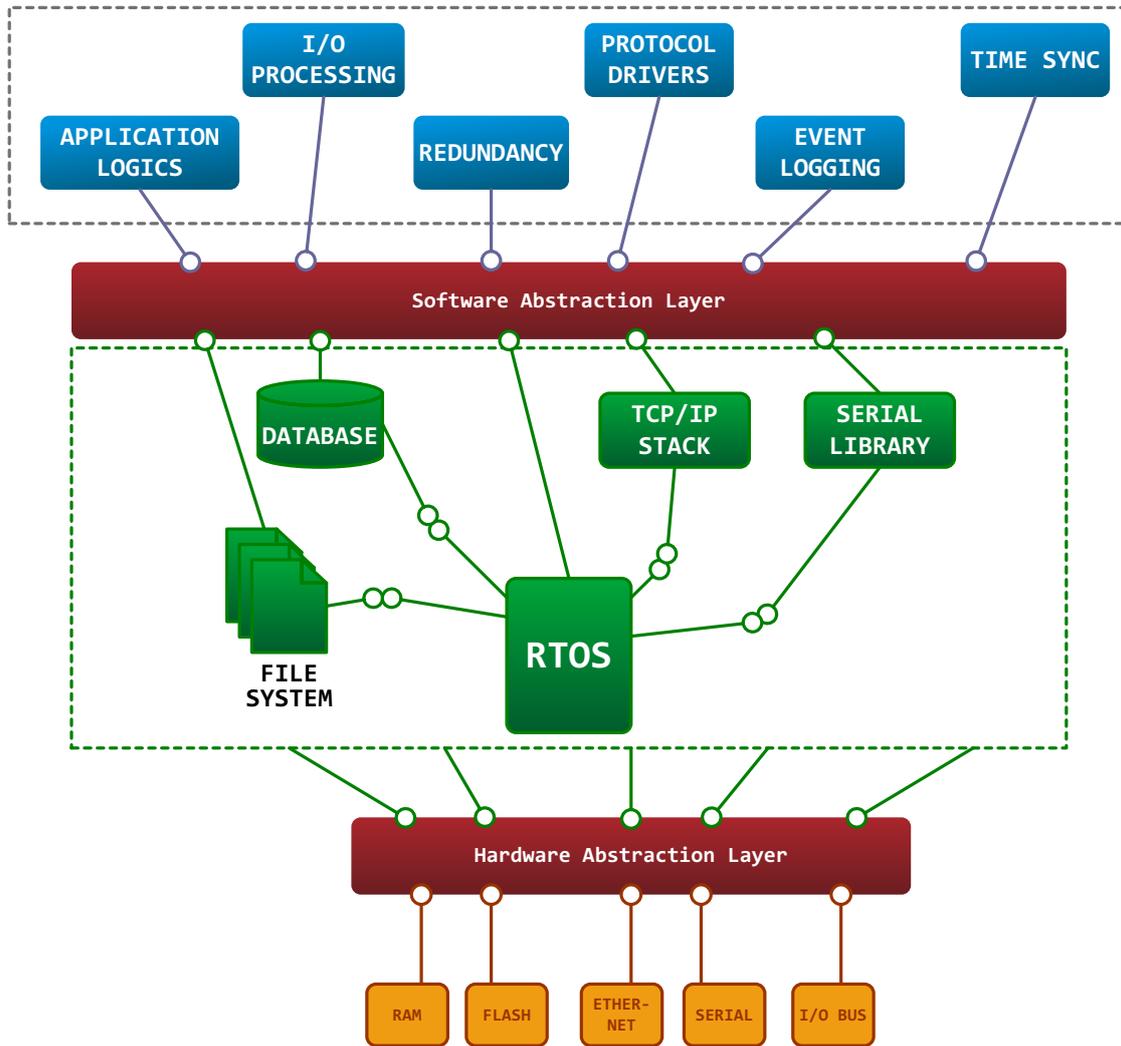
System Tasks

Various functions performed by the RTU are handled by dedicated tasks running inside different processor units of the RTU. The tasks are created automatically and executed based on the user configuration, and based on internal software requirements. Tasks are executed either in a round-robin fashion, or based on interrupts generated by the on-board hardware logic.
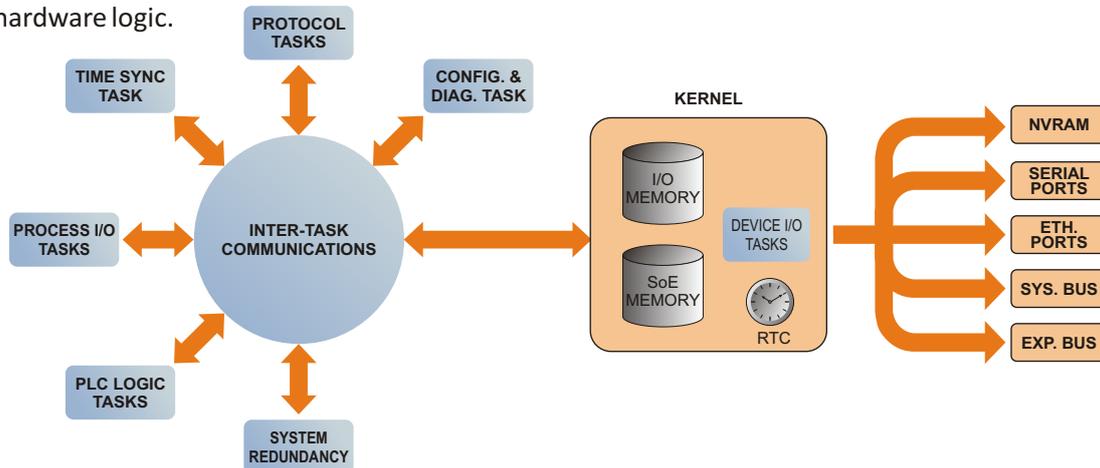
SYSTEM REDUNDANCY

RTU 6049-E70 supports redundancy of the following functions

❍   Rack power supplies – Supports installation of two power supplies in the same rack for redundant operation
❍   Processor module (incl. communication extender modules)
❍   Communication channels towards master stations and IEDs
❍   I/O expansion bus

RTU 6049-E70 supports dual redundancy of the processor modules by having a master-standby mechanism. The two processor modules are installed in separate processor racks which can house the processor and its communication modules. For processor redundancy, the communication modules are duplicated for each CPU, in other words, two identical racks are set-up with the same set of hardware.

PROCESSOR RACK #1   **PROCESSOR RACK #2**

Redundant CPU Racks

Redundant Rack Power Supply

Redundant Comm. Channels

ARCNet Expansion Bus (Redundant)

IED   **IED**   **IED**

I/O RACK

I/O RACK
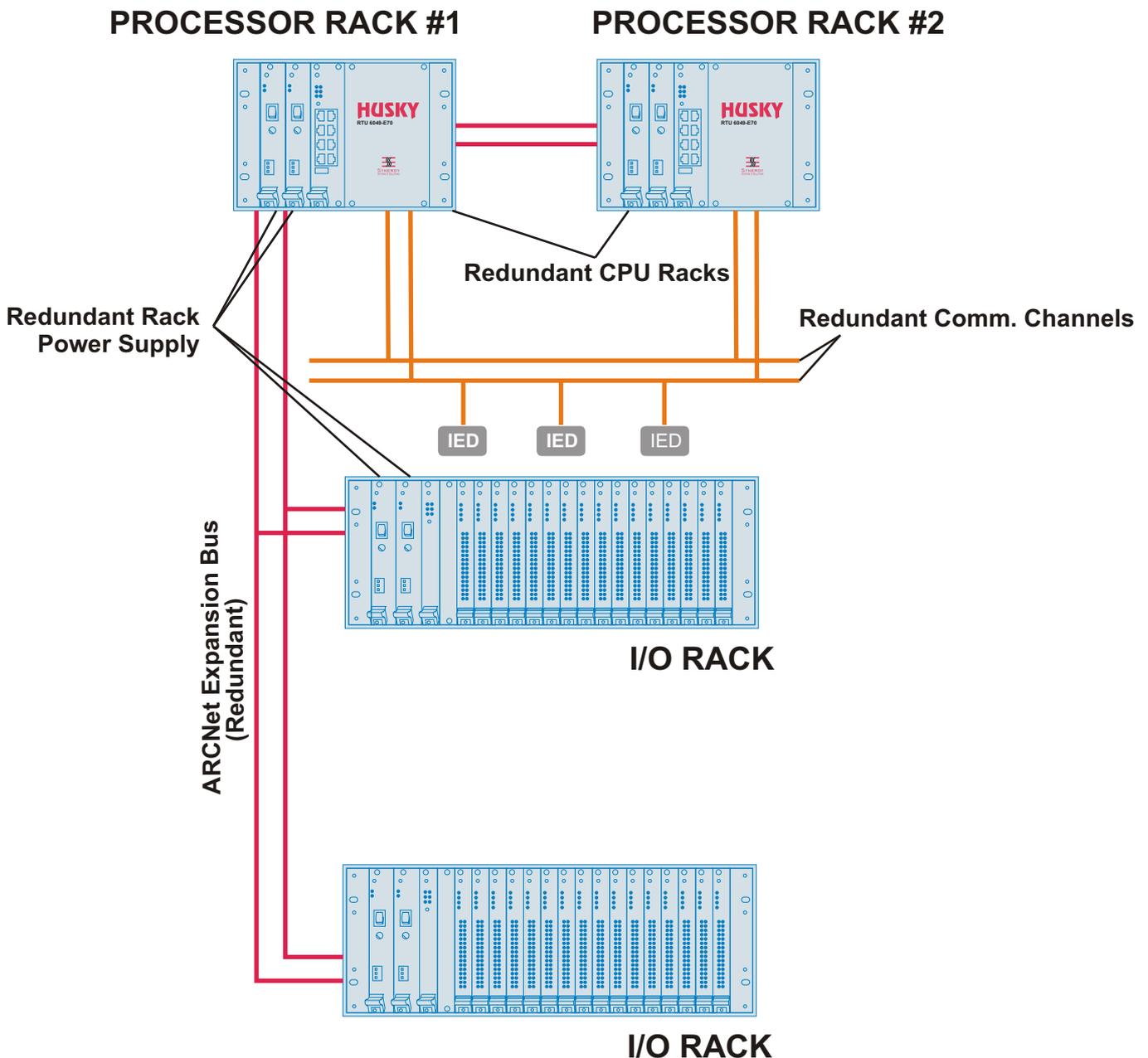
Processor Redundancy

Both the processor racks are interconnected through the ARCNet expansion bus. One of the processor modules assumes the role of the master CPU, while the other assumes the standby role. The master CPU performs all RTU functions including I/O scanning, communications, logic execution, etc. The standby CPU monitors the master CPU, and assumes the master role, in case the master CPU fails. The master CPU synchronizes its memories with the standby CPU over the expansion bus.

Two options are available for implementing processor redundancy. First option allows installing of processor modules in separate racks, each with its own set of power supply and communication extender modules. In this scenario, I/O modules cannot be installed in the processor racks.

The second option provides processor redundancy in the same rack, while sharing the power supply module, and allowing I/O modules to be installed along with the processor module. However, in this arrangement, communication extender modules cannot be installed.

Communications Redundancy

Redundancy of communication channel between RTU and external world (IEDs and master stations) can be enabled in the RTU via Husky Studio. Redundancy of communication channels is based on active-passive concept, wherein one of the two channels is used for active communications, while the passive one is used for periodic health check of the link. When RTU detects failure of the active communication channel, it switches over to the passive channel making it active.

Expansion Bus Redundancy

The expansion bus used to connect additional processor and I/O racks is designed with dual redundant links. This provides a redundancy of the communication media between the racks. Both the links of the expansion bus are used simultaneously thereby having zero switchover time in case of loss of one of the links.

COMMUNICATIONS ARCHITECTURE

RTU 6049-E70 supports both serial-based and Ethernet-based communications on a variety of protocols. Communications can be for either acquisition of data from subordinate devices or transfer of information to a higher level system like SCADA. Further, peer-to-peer or horizontal communications can be performed by the RTU in case of multi-node architectures.

Both serial and Ethernet interfaces are available on the processor module itself. Additional interfaces can be added to the RTU through communication extender modules (CXMs). Up to four CXMs can be installed under a single processor. These modules are installed alongside the processor module in the processor rack and communicate with the processor over the backplane bus.

Protocols

With over 15 years of experience in control systems and with in house designed and developed SIRIUS SCADA system, HUSKY had the head-start in the protocol department. With a support for wide variety of protocols like IEC61850, IEC870-5-10x, DNP 3.0, MODBUS, the RTU can be deployed in almost any process control system.

With support for multiple masters with partitioned database and support for redundant communication links, connectivity is assured. Multiple protocols can be configured on the CPU ports itself thereby eliminating the requirement of separate communication modules.

The RTU can be configured to act as protocol converter or data concentrator. It can collect data from subordinate devices and transmit to master stations on any of the supported protocols. With a powerful configuration editor, I/O mapping between different protocols is a breeze. This allows the RTU to collect data from IEDs like Energy Meters, Numerical Relays, Disturbance Recorders, Governor Controllers, Flow computers, Gas Chromatographs and Station Controllers. RTU 6049-E70 can provide a simplified solution by providing out-of-the-box connectivity solution. It can be used as a Bay Controller, Unit Controller or Station Controller depending upon the process requirements.

Interfaces

RTU 6049-E70 supports traditional copper-based interfaces like RS232, RS485, 10/100-baseT Ethernet. Fibre-optic based Ethernet interface are also available on select CXM modules.

The RTU can also interface with PSTN leased-line or dial-up modems using RS232 ports. Similarly, GSM/GPRS/CDMA modems can be interfaced over RS232 ports for providing wireless connectivity to the RTU. AT commands can be setup in the RTU for configuring the modem settings.

System Bus

The system bus is a set of high-speed busses available on selected slots of the backplane. The system bus is used for communication between the CPU and communication extender modules, or other speciality modules. The system bus consists of a 16-bit parallel interface, and a single channel serial interface.

Both interfaces operate independent of each other, and can be used simultaneously. The exact interface used is dependent on the type of module interacting with the CPU. This bus can be used only on the racks where CPU modules are present.

Comm. Extender Modules (CXM)

Additional serial/Ethernet ports can be added to the CPU by way of installing communication extender modules (CXMs). Communications between the CXMs and the CPU is achieved through the system bus' 16-bit parallel interface via the backplane. The CXMs act as peripheral add-on boards to the CPU module, and provide the required serial and/or Ethernet ports. Therefore, device initialization, data processing, etc. is carried out by the CPU itself.

CXMs can be installed only on the racks where CPU modules are present. These modules can be installed only in specific slots in the backplane (refer to the backplane data sheet for details).

Speciality Modules (SPM)

Speciality modules (SPM) provide a specific function in the RTU that is not achievable through the standard interfaces provided by the standard RTU modules. For example, for providing connectivity between the RTU and a LON-works network, SPM E70-LNA-001 is available. This module handles the LON network interfacing and performs data acquisition, and processing functions on behalf of the CPU. The data thus acquired is transferred to the CPU in a standard manner. Communications between the SPMs and the CPU is achieved through the system bus' serial interface via the backplane.

Remote Manageability

RTU 6049-E70 provides remote management features by providing an integrated browser based interface for managing the RTU from remote locations over the web. This service can be used for monitoring the current RTU status like diagnostics, fault records, etc. Configuration download/upload can also be performed through this interface.

HUSKY Studio can also operate over TCP/IP links. The same can hence be used for configuration and diagnostics if a TCP/IP link is available to the RTU from a remote location.

Pass Through Connectivity

RTU 6049-E70 can provide a transparent Ethernet to serial pass-through channel between a master station connected over TCP/IP and a subordinate device connected to the RTU over an RS232/RS485 port. This feature can be used by an operator at the master station to remotely manage the device without requiring a direct physical connection to the device. This feature can be enabled or disabled by the master station.

PROTOCOLS SUPPORTED

Protocol	Master/Client	Slave/Server
MODBUS RTU/TCP	⊙	⊙
IEC 870-5-101	⊙	⊙
IEC 870-5-103	⊙	
IEC 870-5-104	⊙	⊙
IEC 61850-8-1	⊙	
DNP 3.0 Serial (Level 3)	⊙	⊙
DNP 3.0 TCP (Level 3)	⊙	⊙
RP-570	⊙	
Proteus 2000	⊙	⊙
EQUINODE	⊙	⊙
SPORT	⊙	⊙
Alstom Courier	⊙	
SPA Bus	⊙	
LON Bus	⊙	
SEL ASCII	⊙	
IEC 1107	⊙	

IEC 61850

IEC 61850, the latest standard for communications in substations, defines a data model of the substation domain and a set of services that operate on that data. This standard is now being adopted by other application domains also like wind power, hydro power. RTU 6049-E70 supports both IEC 61850 MMS client and server functions.

Using the IEC 61850 client service, the RTU can be installed in a substation for collecting data from various IEDs on IEC 61850 and transfer it to a master station on protocols like IEC 870-5, DNP3.0. In this scenario, the RTU acts as a gateway for the substation providing access to the modern and traditional IEDs in a substation.

The IEC 61850 server service can be used for transfer of RTU's I/O and any IED data to an IEC 61850 client device using the standard data models. This feature enables integration of legacy IEDs and other sources of information in a substation to a modern substation automation platform.

HUSKY Studio supports import/export of IEC 61850 Substation Configuration Language (SCL) files for fast and easy configuration of the substation database.

CONTROL
CENTRE

LOCAL HMI

IEC 870-5/
DNP3.0

IEC 61850
STATION BUS

IED

IED

IED

IED

FILED I/O
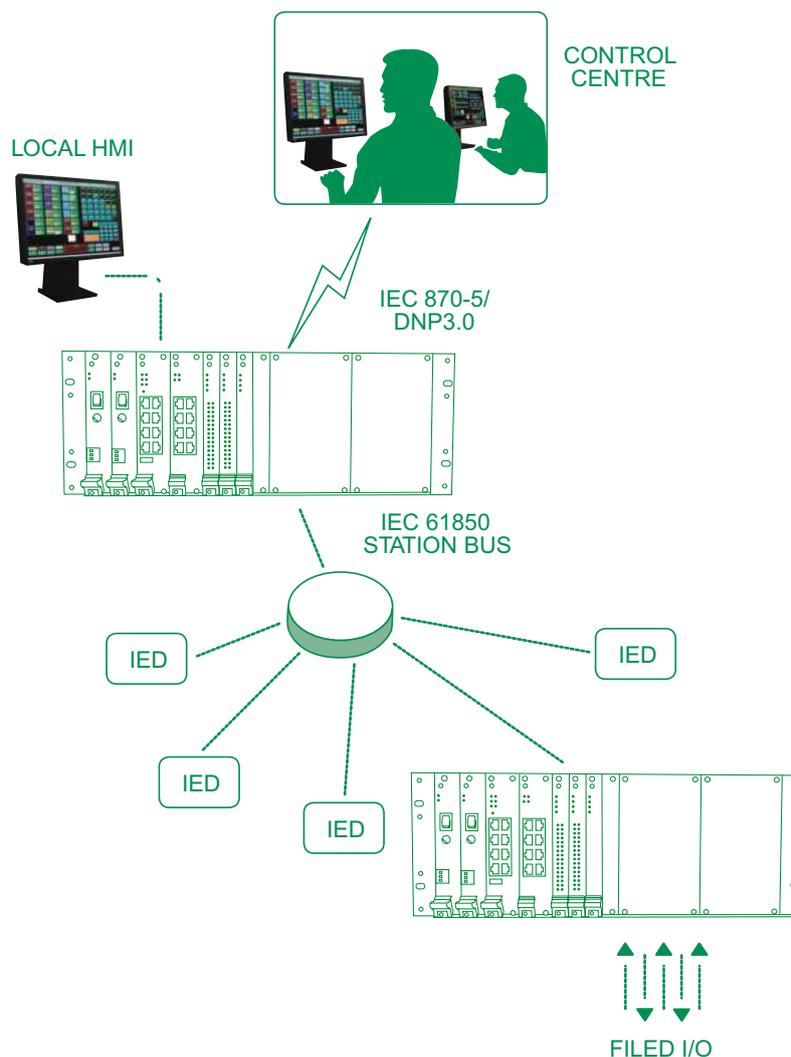
DATA CONCENTRATOR / GATEWAY

In legacy control systems many devices exist which perform a dedicated function and at best, could offer contacts for sensing through a separate local RTU for remote monitoring purpose. This method requires large amount of wiring for implementing remote monitoring and control.

With the advent of Intelligent Electronic Devices (IEDs), which are microprocessor based, it is now possible to gather all data from such dedicated devices by simply communicating with these devices over a communication channel. Many such IEDs supplied by different vendors may exist at one utility. These IEDs communicate over different and often proprietary protocols. Therefore it necessitates installation of a central device whose role is to gather data from all such IEDs and then exchange this data with one or multiple master stations.

HUSKY RTUs can function as a data concentrator or gateway which can interface with the legacy devices and provide a uniform and standard interface towards the master stations.

HUSKY RTUs support the following data concentrator functions

❍   Preserving quality of acquired values, if provided by the IED.

❍   In case an IED does not provide quality information, then the quality is marked as 'good' except when communication   with the IED has failed.

❍   Scaling of resolution of analog values to suit master station

❍   Preserving time stamps of acquired information for SoE

❍   Transfer of comm. status with IEDs to master stations.

❍   Time Synchronization of IEDs.
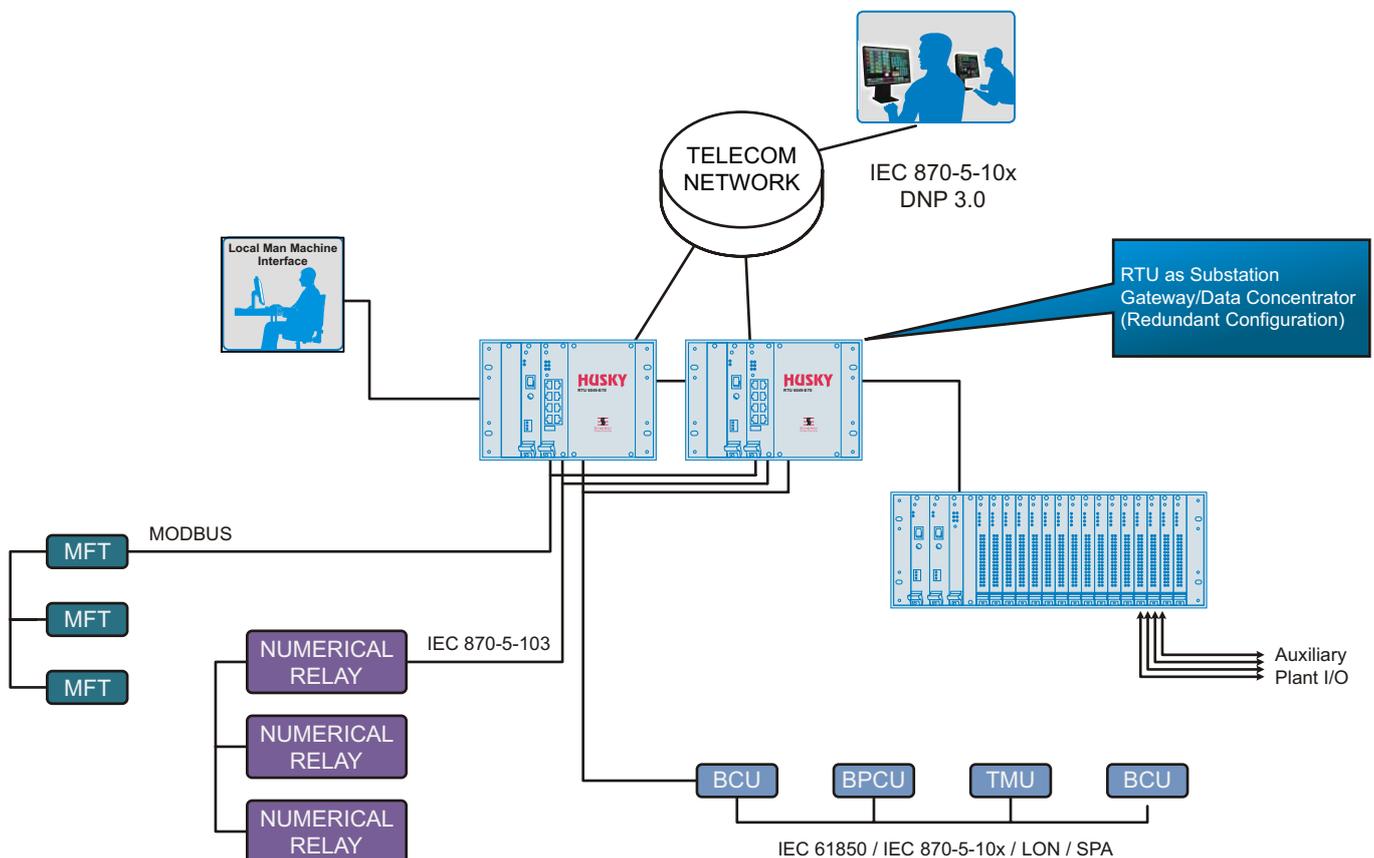
DATA LOGGING

Data logging function is provided in HUSKY for storage of events and analog measurements in a time-stamped manner for future retrieval. Measurements can be logged on cyclical or exception basis in the logs.

Further, logging function also provides support for storage and retrieval of disturbance logs, and metering profiles acquired by the protocol tasks running inside HUSKY.

HUSKY can also convert disturbance records from their native format into COMTRADE format, so that they can be analyzed using vendor-independent tools.

These logs can be acquired by an external system either through the configuration and diagnostics tool, or over a protocol that supports file transfer mechanism.

CONTROL CENTRE

Disturbance Records in COMTRADE / Native Format

IEC 870-5/ DNP3.0

Disturbance Records in Native Format

IEC 870-5-103 / SPA / DNP

NUMERICAL RELAY

NUMERICAL RELAY

NUMERICAL RELAY

BPCU   BPCU   BPCU   BPCU

IEC 61850 / IEC 870-5-10x / LON
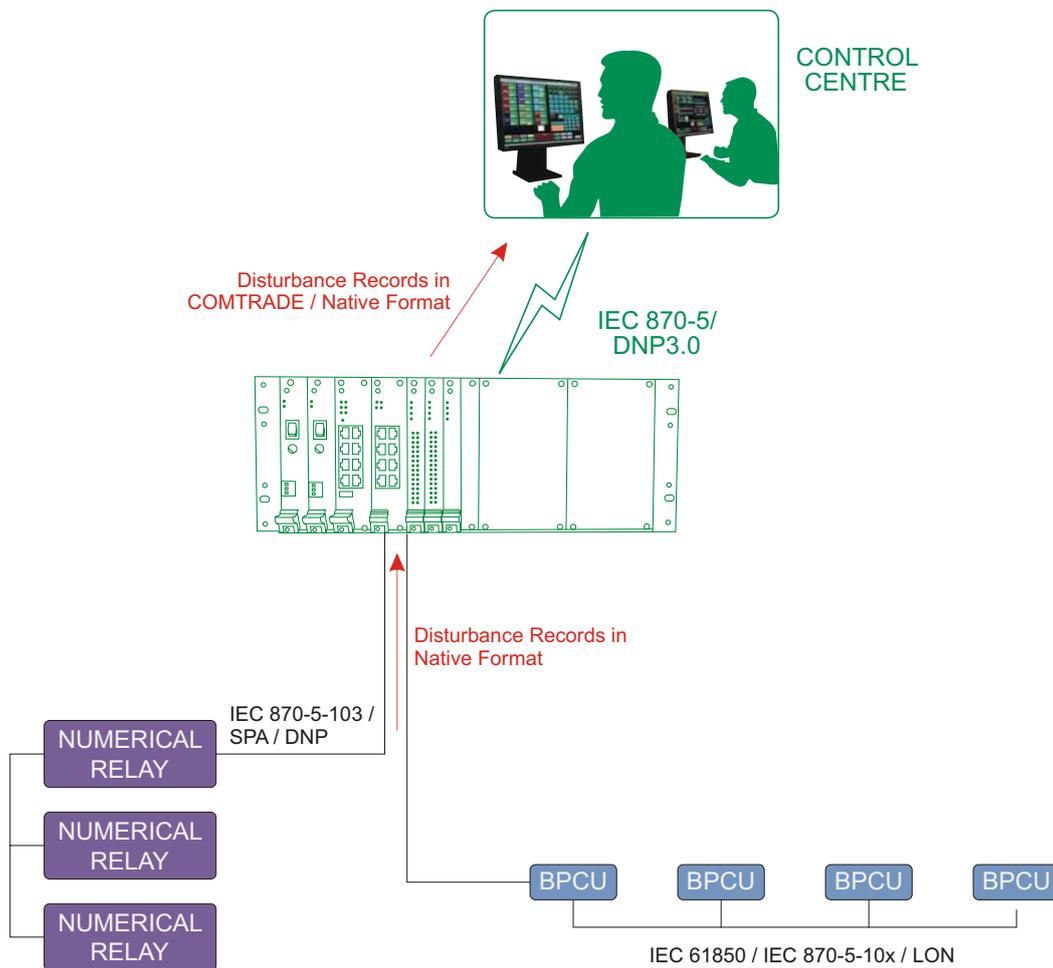
Husky Studio

HUSKY Studio is the unified RTU configuration, programming and diagnostics software. HUSKY Studio is a Windows-based application providing all RTU engineering and programming tasks under one application.

- I/O module configuration including parameters like SoE, chattering, filtering, dead-band etc.
- Protocol configuration along with variable mapping.
- IEC61850 objects configuration and Object browser.
- Time synchronization.
- Upload / Download of RTU configuration.
- Real time monitoring of comm. status with subordinate devices.
- Fault Table View.
- Real-time monitoring of I/O variables with quality.
- Integrated Events viewer with millisecond resolution.
- Offline Logic Simulator for testing of logics without RTU.
- Online Logic Debugger.
- Import/Export of I/O configuration from MS Excel.

Module-specific Input/Output Configuration
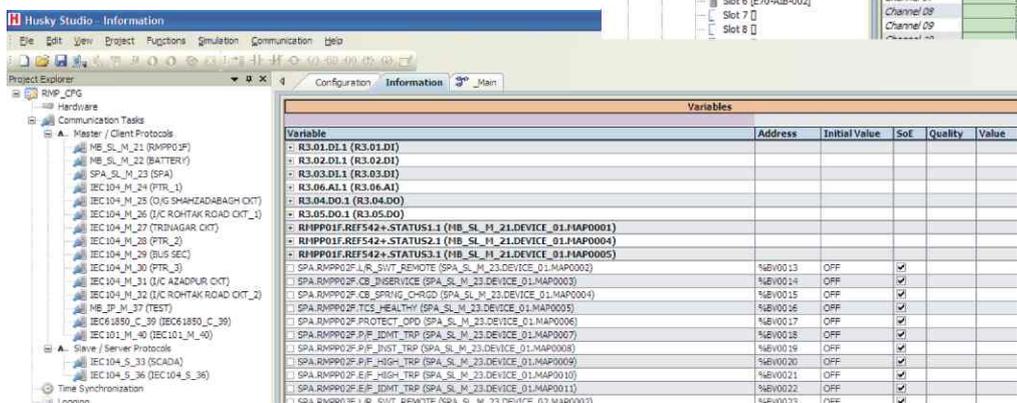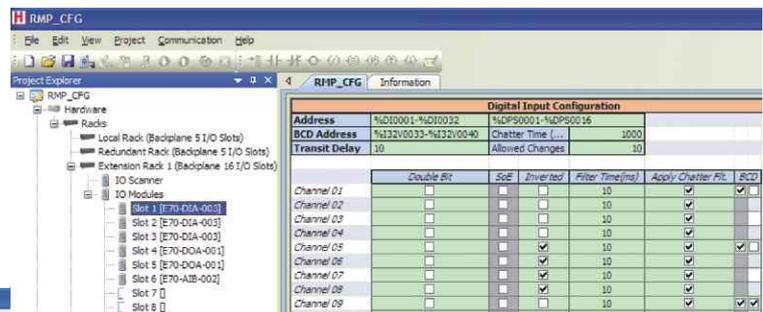
Live watch of variables with current state/quality and manual override facility
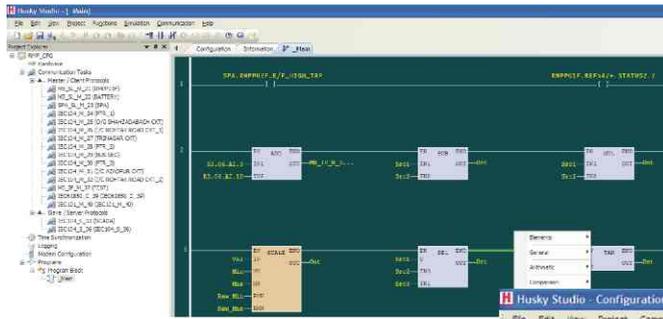
Integrated Ladder Logic Programming Editor/Debugger with simulation capabilities
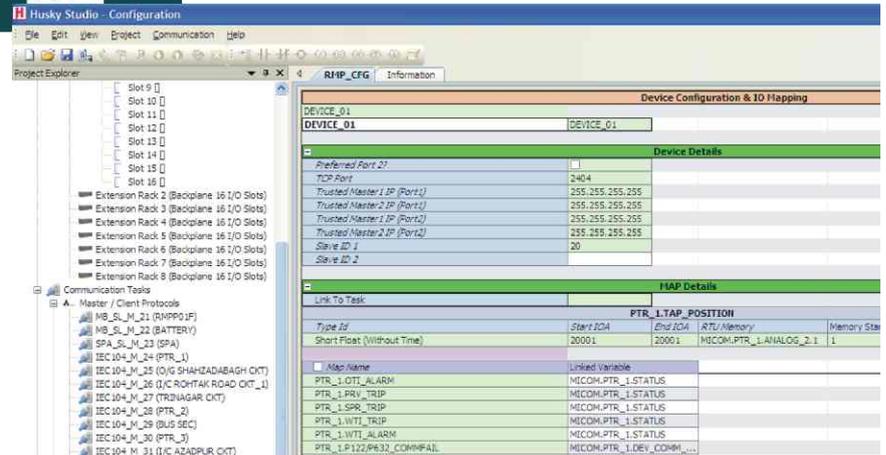
HUSKY Studio is a powerful configuration editor designed for Data Concentrators where large amount of data is transferred across protocols using IO maps. Features like variable naming, filtering allow configuration engineer to map the data across protocols by referring to user friendly names. Built in Event Viewer allows you to view different events, with millisecond timestamp, in the RTU itself.

HUSKY Studio also supports IEC61850 Substation Configuration Language (SCL) and can import SCL files (.CID, .ICD, .SCD) and create the IEC61850 database maps automatically. This helps in rapid and less error-prone system deployment.

Commands can also be issued directly from the variables view. The commands can either be hardwired or on a remote device connected to Husky. Select-Before-Execute commands can also be executed from the Husky Studio.

Apart from configuration of local and extension racks, I/O modules and protocols, it integrates a IEC 61131-3 ladder logic editor and simulator. Engineers can now write ladder logics and even test them without the RTU. With its powerful offline logic simulator, it allows engineers to run through the logic in offline mode. Values of different variables can be simulated in the simulator for exact real-time execution. This removes the dependency on the actual device thereby increasing the overall productivity of the engineer.

Security Features

With RTUs being installed in applications where access is over open, un-trusted, public networks, cyber security is an important requirement in an RTU. RTU 6049-E70 has a built-in firewall mechanism that allows only specified ports to be accessed by external clients. The RTU also supports SSL/TLS encrypted virtual private networks (VPN) which allow communication with remote devices over a secure channel. For server protocols, access control lists can be defined to restrict the clients that can access the server.

Audit logs are maintained by the RTU which log all connection requests, rejection, acceptance, etc. These logs can be accessed through HUSKY Studio or the web interface for monitoring of unauthorized access. This helps in owners achieving regulatory compliances like NERC/CIP, FERC, etc.

For pass-through connections supported by the RTU, specially designated virtual tags are maintained which indicate the status of disabled/enabled and granted connections.

- Audit Log for
    - User Actions
    - Connection Attempts
    - Connection Rejections
    - Configuration Changes etc.
- Built-in Firewall
    - Only required ports are opened
- Electronic Security Perimeter between WAN and LAN
- SSL/TLS Encrypted Data Exchanges
- Access Control Lists
- Secure Execution Environment
    - Third-party programs cannot be executed

CONTROL CENTRE

Internet / VPN

SSL/TLS Encrypted Data Exchange

Electronic Security Perimeter

HUSKY
RTU 6049-E70

MFT   BCU   NUMERICAL RELAY
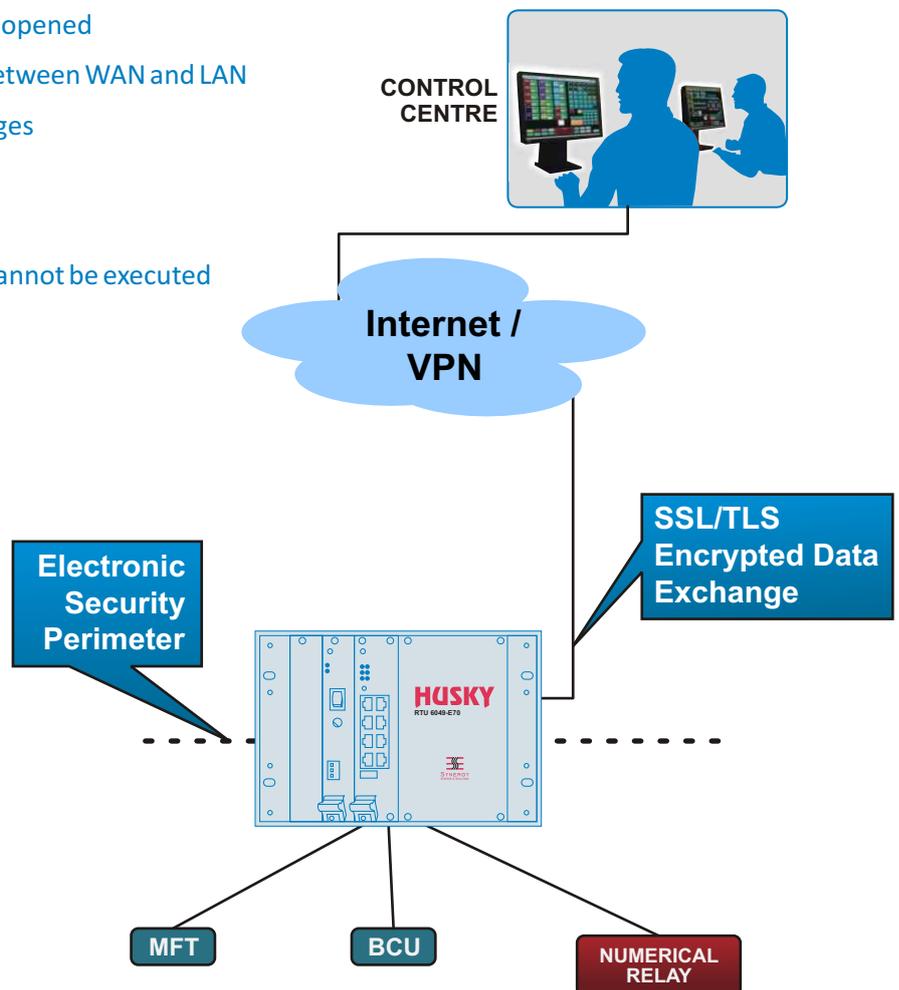
Programmability

Custom application logics can be programmed in the RTU using the IEC 61131 ladder logic. Standard functions and function blocks as per the IEC standard are built-in and additional user-defined functions and function blocks can be added.

HUSKY Studio provides the programming, debugging tools required for implementing these logics.

Husky supports IEC61131 ladder logic programming language for custom application logics. Ladder logic editor is integrated with HuskyStudio to provide users with a seamless interface. Husky supports standard IEC61131 function blocks along with custom function blocks provided to enhance the RTU programmability. Unlike other programming software, Husky users can freely move variables across different data types without using any special "MOV" blocks. Offline debugging capabilities allow programmers to debug their logics without having to connect to an actual device. Built in function blocks, in addition to IEC standards, like date-time, array shifting, timers etc. provide flexibility as well as convenience to programmers.

Some of the salient features are:

❍   Availability of standard functions as per IEC61131-3.

❍   Integrated logic editor with HuskyStudio.

❍   Supports custom function blocks.

❍   Supports offline debugging of logics without requiring any device.

❍   Supports "Single Cycle" simulation for easier debugging.

❍   Supports "Automatic Placement" of logic elements eliminating the need to connect them manually.
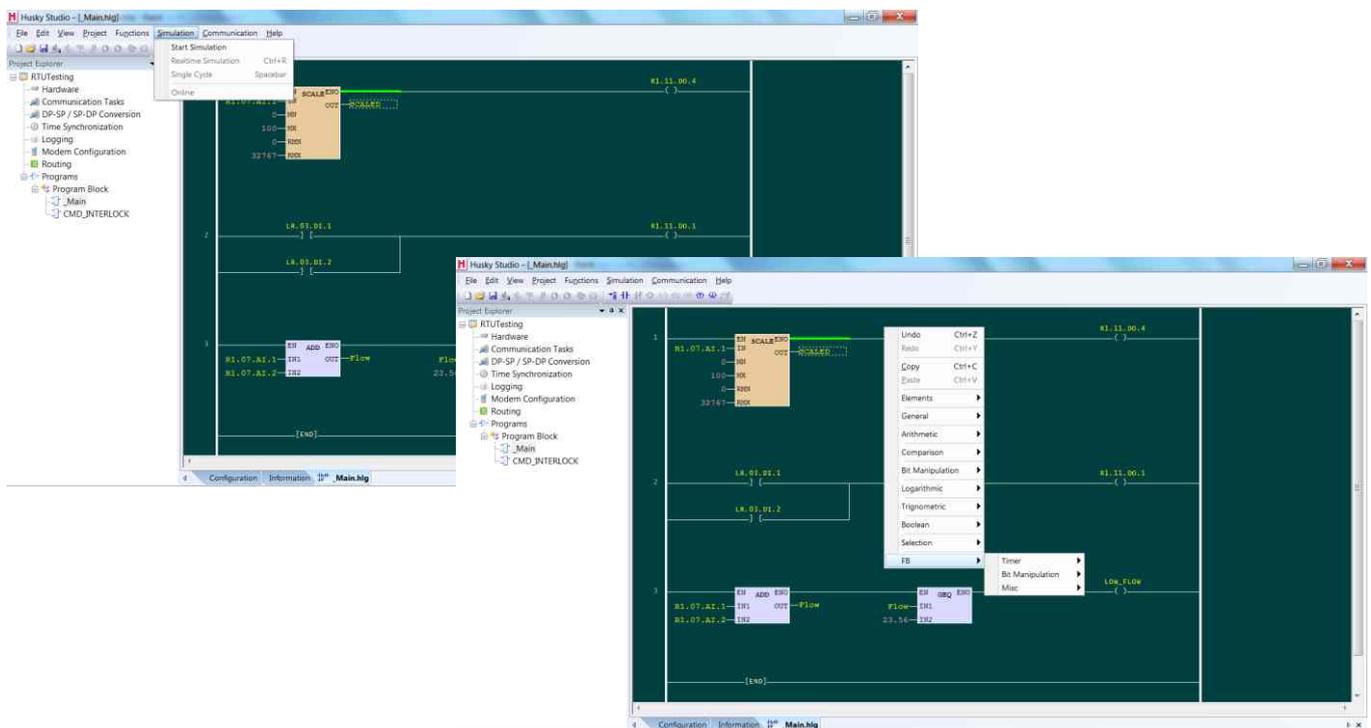
ENVIRONMENTAL COMPLIANCE

All components selected for HUSKY RTUs are compliant to RoHS directive. RoHS directive is a single market directive on the restriction of certain hazardous substances. It seeks to reduce the environmental degredation by restricting the use of certain hazardous substances during the manufacturing of electrical and electronics products.

TEST	SPECIFICATIONS
Dry Heat Test	80°C for 96 hours
Damp Heat Test	40°C, 95%RH for 10 hours
Cold Test	0°C for 16 hours
Temperature Cycling Test	0°C to 50°C to 0°C @ 1°C /min for 5 cycles
Vibration Test	10-59Hz with displacement of 0.15mm Acceleration of 2g for 2hrs on each axis
Surge Immunity Test	IEC 60870-2-1, Level 3 Pulse: 1.2/50µS, 2kV CM, 1kV DM amplitude
Electrical Fast Transient Burst Test	IEC 60870-2-1, Level 3
Damped Oscillatory Wave Test	IEC 60870-2-1, Level 3
Electrostatic Discharge Test	IEC 60870-2-1, Level 3
Radiated Electromagnetic Field Test	IEC 60870-2-1, Level 3
Power Frequency Magnetic Field Test	IEC 60870-2-1, Level 3
Damped Oscillatory Magnetic Field Immunity Test	IEC 60870-2-1 Field: 30A/m @ 1MHz
Insulation Resistance Test	IEC 60870-2-1, 500VDC
Power Frequency Voltage Withstand Test	IEC 60870-2-1, 1kVAC for 1 minute
Impulse Voltage Test	IEC 60870-2-1 Pulse: 1.2/50µS, 5kV amplitude

NETWORK TOPOLOGY

MASTER CONTROL CENTRE NO.1   MASTER CONTROL CENTRE NO.2   MASTER CONTROL CENTRE NO.3   MASTER CONTROL CENTRE NO.4

TCP/SERIAL

OPTICAL TO COPPER CONVERTER

ARCNet

MAIN CPU

REDUNDANT CPU

RTU 6049-E70

RTU 6049-E70

TO REDUNDANT CPU

LOCAL IO RACK #1

RTU 6049-E70

OFC

LOCAL IO RACK #2

REMOTE IO RACK

RTU 6049-E70

RTU 6049-E70

LOCAL MAN MACHINE
INTERFACE

ENGG. & DIAGNOSTIC
TOOL

MULTIPLE STD.
TIME SOURCES

MODEM

IED #1

WIRELESS MODEM

IEC-61850

SLAVE RTU

IED #n

RTU 6049-E70

IED #1

IEC-870-5, DNP3.0, MODBUS
ETH/RS232/RS485

IED #n

HUSKY™
6049-E70

CPU E70 is a high performance versatile CPU powered by a fan-less 400 MHz processor. Part of Husky series RTU, CPU E70 is equipped with 2 nos. of Ethernet ports and 6 nos. of serial ports to suit any application requirement.

GENERAL TECHNICAL DESCRIPTION

CPU E70 consists of a SOM, designed specifically for embedded systems. The SOM comprises of MPC5125, Power PC chip along with high speed RAM and NAND flash. A hardware watchdog monitors the CPU healthiness.

CPU E70 communicates with various IO modules over CAN Bus. The communication follows the "Producer & Consumer" approach where IO modules produce the data to be consumed by CPU. Error in IO modules is indicated via CB1E LED on the CPU faceplate.

Communication with Expansion Racks is via high speed 10 MBPS ARCNet. A dedicated FPGA on the CPU handles the ARCNet stack that allows the CPU to concentrate on other tasks.

128MB of NAND flash is used for storage of configuration and other information. Special NAND flash driver with "wear-leveling" optimization has been incorporated inside the CPU. Additional 512KB of battery backed RAM is used for storage of events and RTC time in the CPU. Low battery alarm is available from the CPU under the diagnostic information.

ETHERNET COMMUNICATION

CPU E70 is equipped with 2 nos. of 10/100 MBPS auto MDI-X Ethernet ports for TCP/IP based communication. CPU auto detects the communication speed and adjusts accordingly. Both the ports are surge protected and provide isolation up to 1 KV. The default IP address of the CPU ports is as below:

Default IP ETH1: 195.1.1.1

Default IP ETH2: 195.1.2.1

SERIAL COMMUNICATION

Built-in six serial ports ensure that communication requirements of even most demanding applications are met with ease. DMA enabled serial communication frees the CPU from serial data transfer and allows the CPU to concentrate on other high priority tasks.

frees the CPU from serial data transfer and allows the CPU to concentrate on other high priority tasks.

All ports on the CPU are surge protected and isolated. Modem signals are available on the selected ports for slow speed communication like PLCC modems.

TIME SYNCHRONIZATION

CPUE70 can be time synchronized by means of a PPS/PPM pulse from an external GPS receiver, SNTP, serial line (NMEA) 0183 or via master station. Multiple time sources can be configured for fail safe operations. A battery backed RTC along with temperature controlled crystal oscillator(TCXD), maintains the time with resolution of 1 ppm. RTC is synchronized automatically when time is received either from GPS or master station. Expansion racks and various IO cards are synchronized by the CPU.

SERVICE PORT

CPU E70 does not provide a dedicated service port. Service port can be configured by user as per requirement. Up to two service ports can be configured. A service port can be any serial or Ethernet port configured in the CPU. By default, both the Ethernet ports are configured as service ports.

Important: Please note that configuring ETH1 / ETH2 as service ports does not reserve / block the port for other purposes. Both the ports can be used for communication protocols.

EXPANSION RACKS

Up to eight expansion racks can be configured along with local rack. In case of redundant CPU configuration, IO can only be configured in expansion racks. Fault in expansion rack is indicated via CB2E fault LED on the face plate.

TECHNICAL SPECIFICATIONS

CPU Type	Two slot CPU module with embedded Ethernet and Serial Ports
Processor	MPC5125 with e300 CPU core based on the Power Architecture
Speed	400 MHz, 800 MIPS
RAM	128 MB
Flash	128 MB NAND Flash for configuration and program storage 512KB battery-backed RAM for Event storage
Serial	Up to 6 serial ports
	DMA Operated
	RS232 / RS485 software selectable
	Bit Rate <= 115200
	Full modem signals on select ports
	Surge protected
	Isolation = 3 KV

Ethernet	2x10/100 MBPS with Auto MDI-X Surge protected Isolation = 1KV
USB	1; for firmware upgrade
Local Bus	1 Mbps CAN Bus
Expansion Bus	10 Mbps ARCNet Bus
Parallel Bus	16 bit
Expansion Racks	8 expansion racks with total of *Subrack Connector*
Ethernet Interface	RJ 45
Serial Interface	RJ 45
USB Interface	Type A
Power Consumption	7.5 W
Operating Temp.	0-70°C
Relative Humidity	95% Non-condensing
Dimensions	4U High x 8T, 2 Slot Width

JUMPER SETTINGS

Jumper	Purpose	Setting
J2	Safe mode boot	1 ▬ 2 Boot with default factory settings 1 ☐ 2 Boot in normal mode
J2 (SOM)	Watchdog	1 ▬ 2 Hardware Watchdog Enable
J4	COM1 RS485 Termination Resistor	1 ▬ 2 120 termination
J5	COM2 RS485 Termination Resistor	1 ▬ 2 120 termination
J7	COM3 RS485 Termination Resistor	1 ▬ 2 120 termination
J8	COM4 RS485 Termination Resistor	1 ▬ 2 120 termination
J9	COM5 RS485 Termination Resistor	1 ▬ 2 120 termination
J15	COM6 RS485 Termination Resistor	1 ▬ 2 120 termination
J11	COM5 DCD / RS485	1 ▬ 3 Rs485 1 ▬ 3 RS232
J12	COM5 DSR / RS485	1 ▬ 3 RS485 1 ▬ 3 RS232
J13	COM6 DCD / RS485	1 ▬ 3 RS485 1 ▬ 3 RS232
J14	COM6 DSR / RS485	1 ▬ 3 RS485 1 ▬ 3 Rs232

LED INDICATIONS

LED	Purpose
PWR	Power ON
FAULT	Fault Entry Present
RUN	1 Hz : Safe Mode 5 Hz : Normal Mode
MASTER	ON: Master CPU OFF: Standby CPU
CBE1	Fault in Local Rack
CBE2	Fault in Expansion Rack
LAN	▬ ON: Link ▬ BLINK: Activity ▬ ON: 100 Mbps ▢ OFF: 10 Mbps
COM	▬ Tx ▬ Rx

CPU CARD

RS232 PIN DESIGNATION

Pin	Signal Name
1	DSR (available only in COM5 & COM6)
2	DCD (available only in COM5 & COM6)
3	DTR
4	GND
5	RX
6	TX
7	CTS
8	RTS

ORDERING INFORMATION

Order Code	Specifications
E70-CPU-001	6x RS232/RS485 Ports 2x 10/100Mbps Ethernet Ports
E70-CPU-002	4x RS232/RS485 Ports 2x 10/100Mbps Ethernet Ports
E70-CPU-003	2x RS232/RS485 Ports 2x 10/100Mbps Ethernet Ports

RS485 PIN DESIGNATION

Pin	Signal Name
1	A (–)
2	B (+)

HUSKY™
6049-E70

CXM-00x is an extension of CPU E70, which provides capabilities to extend communication ports capacity of the main CPU. CXM-00x provides additional serial and Ethernet ports and communicates with the main CPU over parallel bus running through the backplane.

GENERAL TECHNICAL DESCRIPTION

CXM-00x provides 2-6 serial ports and maximum two nos. of Ethernet ports. CXM-00x consists of a microcontroller that facilitates direct communication between CPU and ports hardware. This allows CPU to access ports directly providing faster access to the applications. All ports are surge protected and isolated.

CXM-00x is not a standalone unit and requires CPU00x for functioning. CXM-00x can only be installed in first four slots of CPU rack. It can not be installed in expansion racks.

ETHERNET COMMUNICATION

CXM-00x, depending upon model, can provide 2 nos. of 10/100 MBPS auto MDI-X Ethernet ports for TCP/IP based communication. CXM auto detects the communication speed and adjusts accordingly. Both the ports are surge protected and provide isolation up to 1 KV. There is no default IP of the CXM Ethernet ports. When cards are added during the configuration, IP address is automatically calculated based on the IP address assigned to the CPU.

SERIAL COMMUNICATION

Depending upon the model, CXM-00x can provide up to six serial ports ensuring that communication requirements of even most demanding applications are met with ease.

All ports on the CXM are surge protected and isolated. Modem signals are available on the selected ports for slow speed communication like PLCC modems.
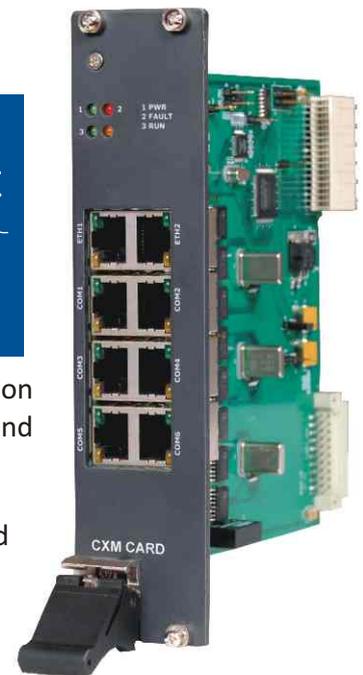
TECHNICAL SPECIFICATIONS

CPU Type	Multiple CPLD (Complex Programable Logic Device) Architecture
Ethernet	2x10/100 MBPS Ethernet ports with Auto MDI-X Surge protected Isolation = 1KV
Serial	Up to 6 nos serial ports RS232 / RS485 software selectable Bit Rate <= 115200 Full modem signals on select ports Surge protected Isolation = 3 KV
Parallel Bus	16 Bit
Ethernet Interface	RJ 45
Serial Interface	RJ 45
Power Consumption	3W max
Operating Temp.	0-70 Deg C
Relative Humidity	95% non condensing
Dimensions	4U high x 8T wide, occupies 2 slot widths

JUMPER SETTINGS

Jumper	Purpose	Setting
J5	COM1 RS485 Termination Resistor	1 □ 2 120 termination
J6	COM1 DCD / RS485	1 □ 3 Rs485 1 □ 3 RS232
J7	COM1 DSR / RS485	1 □ 3 Rs485 1 □ 3 RS232
J9	COM2 RS485 Termination Resistor	1 □ 2 120 termination
J10	COM3 RS485 Termination Resistor	1 □ 2 120 termination
J11	COM3 DCD / RS485	1 □ 3 Rs485 1 □ 3 RS232
J12	COM3 DSR / RS485	1 □ 3 Rs485 1 □ 3 RS232
J14	COM4 RS485 Termination Resistor	1 □ 2 120 termination
J15	COM5 RS485 Termination Resistor	1 □ 2 120 termination
J17	COM6 RS485 Termination Resistor	1 □ 2 120 termination

LED INDICATIONS

LED	Purpose
PWR	Power ON
FAULT	Fault Entry Present
ACT	Data exchange with CPU
LAN	ON: Link
	BLINK: Activity
	ON: 100 Mbps
	OFF: 10 Mbps
COM	Tx
	Rx
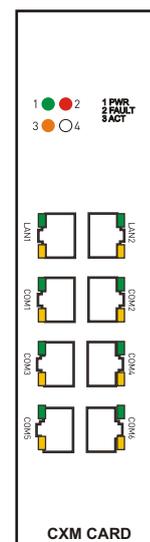
CXM CARD

RS232 PIN DESIGNATION

Pin	Signal Name
1	DSR (available only in COM5 & COM6)
2	DCD (available only in COM5 & COM6)
3	DTR
4	GND
5	RX
6	TX
7	CTS
8	RTS

RS485 PIN DESIGNATION

Pin	Signal Name
1	A aka "-" aka TXD-/RXD-
2	B aka "+" aka TXD+/RXD+
4	GND

ORDERING INFORMATION

Order Code	Specifications
E70-CXM-001	6x RS232 / RS485 Ports, 2x Ethernet Ports
E70-CXM-002	4x RS232 / RS485 Ports, 2x Ethernet Ports
E70-CXM-003	2x RS232 / RS485 Ports, 2x Ethernet Ports
E70-CXM-004	6x RS232 / RS485 Ports, 1x Ethernet Ports
E70-CXM-005	4x RS232 / RS485 Ports, 1x Ethernet Ports
E70-CXM-006	2x RS232 / RS485 Ports, 2x Fiber Optic Ethernet Ports
E70-CXM-0xS	CXM model with only RS232 / RS485 serial ports
E70-CXM-0xE	CXM model with only Ethernet ports

HUSKY™
6049-E70

Power Generation

Power Transmission & Distribution

Oil & Gas
Transmission & Distribution

Railway
Traction

IOS-00x, known as IOScanner, is a bus expansion module that extends the capability of the CPU to interrogate data from expansion racks. IOScanner interrogates the IO cards installed in its rack and transfers the data and SoE to CPU in form of memory blocks. A dedicated "Hot Swap Controller" is present on the card to allow fail safe hot swapping of cards without affecting the backplane bus.

GENERAL TECHNICAL DESCRIPTION

IOScanner communicates with CPU over high speed ARCNet bus that connects multiple expansion racks to the main CPU rack. IOScanner receives configuration data from CPU and subsequently configures the cards installed in its expansion rack. IOScanner independently collects data and SoE from IO cards and transfers the same to CPU over ARCNet. Individual cards are diagnosed by the module, every cycle, using diagnostic messages. Faults in IO cards and IOScanner are reported to CPU using special messages.

In multiple expansion rack configuration, IOScanner relieves the CPU from data collection task and provides the process data in the form of memory blocks.

Up to eight expansion racks can be connected to the CPU.

Using RS485 media, expansion bus can be extended up to 30m and by using FO model (multi-mode fiber), expansion bus can be extended up to 2 km.

TECHNICAL SPECIFICATIONS

CPU Type	32 bit microcontroller & FPGA for ARCNet comunication
Speed	80 MHz
Local Bus	1 MBPS CAN BUS
Expansion Bus	10 MBPS ARCNet
Power Consumption	3W max
Operating Temp.	0-70 Deg C
Relative Humidity	95% Non Condensing
Dimensions	4U High x 4T wide, occupies 1 slot

DIP SWITCH SETTINGS

Rack ID	ID:1	ID:2
BUS Speed (Mbps)	2.5	5	10

ORDERING INFORMATION

Order Code	Specifications
E70-IOS-001	Expansion Rack IO Scanner for Copper Media
E70-IOS-002	Expansion Rack IO Scanner for Fiber Optic

HUSKY™
6049-E70

DIA00x, part of Husky series RTU, is a multi-function 32 channel digital input card with an onboard 32 bit microcontroller for providing accurate time stamping of events. It has on board storage to store 3 events per channel, along with time stamp, to be transferred later to CPU. A dedicated "Hot Swap Controller" is present on the card to allow fail safe hot swapping of cards without affecting the backplane bus.

GENERAL TECHNICAL DESCRIPTION

DIA00x is a positive logic binary input card that provides isolated inputs, in groups of eight, for 32 process signals. Input scanning is executed at high resolution of 500 microseconds with a time stamp accuracy of 1 millisecond. Following additional functionalities are provided:

○ 32 Single Channel input

○ 16 Double Channel Input

○ 8 nos. 32 bit Pulse Counters with max frequency of 1KHz

○ Configurable BCD with minimum 4 channels in a single digit

8 inputs form a single group with common return. 32 inputs form four groups. Each input channel is protected from high voltage and surges via means of re-settable fuse and MOVs. Each channel is galvanically isolated by means of opto-coupler.

DI card can sense 110VDC, 48VDC or 24VDC depending upon the order selection. Status changes of 1 millisecond can also be captured by the card.

Each channel has a corresponding LED on the front plate of the card that is directly linked to the input.

When powered on, the card carries out a self diagnostic procedure to determine the healthiness of critical hardware components. Faults are reported via fault LED on the front plate.

DI card is EMI/EMC compliant as per standard IEC60870-2-1, Level 3.

PROCESSING FUNCTIONS

DIA00x can execute following processing functions on the input channels, depending upon the configuration:

○ Chatter filter with 6000 samples per channel. Chatter filter is configured at a single place but can be applied on channel basis.

○ De-bounce filter, configurable per channel, with filter period from 1-255 milliseconds.

○ SoE configurable per channel

○ Intermediate position (Transient state) suppression for monitoring of double bit inputs

○ Pulse counting on first eight channels with up to 1 KHz pulse input. The pulse counting can be configured either FormA or FormB. Pulse counters are stored in 32bit registers and reported as counters.

Processing on the card is carried out by the on board microcontroller. The card communicates with the CPU over 1 Mbps CAN bus. Configuration data is received from CPU and different processing functions are activated accordingly. The data is scanned by microcontroller at regular intervals and appropriate processing functions are applied. If an input is found chattering, the value is automatically blocked. The channel is automatically de-blocked when the input stays at a particular level.

Input data set is transmitted to CPU upon receiving a sideband signal. This allows card and CPU to follow "producer & consumer" approach of data exchange with bus control functionality handled by CPU.

TECHNICAL SPECIFICATIONS

Processor	32 bit microcontroller
Points	32 Channels, 4 groups of 8 or 16 channels with individual return
Pulse Counter	First eight channels. 1KHz maximum
BCD	Max eight BCD inputs for 32 channel card. Minimum 4 channels per BCD digit.
Isolation	3.7KV DC
Isolation between groups	500VDC
Protection	Surge & Overload
Input Filter	Settable from 1-255 msec in configuration
Chatter Filter	Yes
Power Consumption	2.5W max
Operating Temperature	0-70 Degree C
Relative Humidity	95% non condensing
I/O Connections	2x20 pin pluggable connector on chassis backplane
Dimensions	4U high x 4T wide, 1 slot width
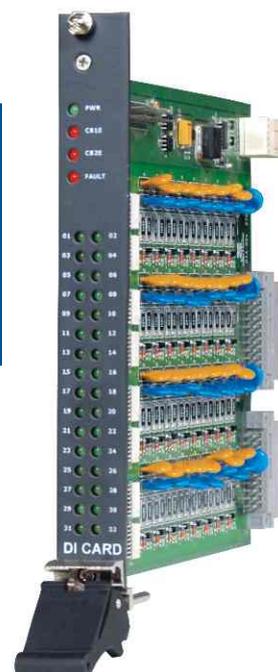
Card Model	E70-DIA-001	E70-DIA-002	E70-DIA-003
Nominal Input Voltage	110VDC	48VDC	24VDC
On Input Range	80-120VDC	38-50VDC	15-30VDC
Off Input Range	0-56VDC	0-24 VDC	0-12VDC
Input Current (per channel)	< 3mA	< 2mA	< 1mA

LED INDICATIONS

LED	Purpose
PWR	Indicates presence of input power
CB1E, CB2E	Error in backplane IO bus
FAULT	Indicates presence of critical fault in module
01 … 32	Channel status. When lit, means ON

ORDERING INFORMATION

Order Code	Specifications
E70-DIA-001	32 Channels, Positive Logic, 110VDC Input
E70-DIA-002	32 Channels, Positive Logic, 48VDC Input
E70-DIA-003	32 Channels, Positive Logic, 24VDC Input

DIGITAL INPUT WIRING

DI1

TB1

1	2	3	4	5	6	7	8

DI1C-A1/TB1-1
DI1C-A2/TB1-2
DI1C-A3/TB1-3
DI1C-A4/TB1-4
DI1C-A5/TB1-5
DI1C-A6/TB1-6
DI1C-A7/TB1-7
DI1C-A8/TB1-8
DI1C-A9/0 VDC

24 VDC
0 VDC

C

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10

IE
IE

DI1C-B1/TB1-9
DI1C-B2/TB1-10
DI1C-B3/TB1-11
DI1C-B4/TB1-12
DI1C-B5/TB1-13
DI1C-B6/TB1-14
DI1C-B7/TB1-15
DI1C-B8/TB1-16
DI1C-B9/0 VDC

24V DC
0 VDC

TB1

9	10	11	12	13	14	15	16

HUSKY™

6049-E70

Power Generation

Power Transmission & Distribution

Oil & Gas
Transmission & Distribution

Railway
Traction

E70-DOA-00x, part of Husky series RTU, is 16 / 8 channel potential free, normally open, digital output card with an onboard 32 bit microcontroller. It is equipped with a feedback monitoring circuit to provide accurate feedback for "Select Before Execute" commands. A dedicated "Hot Swap Controller" is present on the card to allow fail safe hot swapping of cards without affecting the backplane bus.

GENERAL TECHNICAL DESCRIPTION

DOA00x is a binary output card that provides isolated outputs, in groups of eight, for 16 process outputs. Following additional functionalities are provided:

- 16 nos. Single Channel Output
- 8 nos. Double Channel Output
- SBE or Non SBE Configuration
- For Non SBE cards, individual channel selectable for Pulse and Latch functionality
- Accepts SBE commands even for Non SBE configuration for backward compatibility with systems

8 outputs form a single group with common supply. Groups are potentially isolated from one another as well as from other logics. Each group is provided with a master relay along with relays for individual channels. When command is received from the CPU, it is routed to the output channel through selection of corresponding channel and master relay. In case of SBE output, the feedback is monitored before master relay is actuated.

Each channel has a corresponding Select and Execute LED on the front plate of the card that is directly linked to the output. When output is triggered, corresponding LED is triggered to reflect the command status.

When powered on, the card carries out a self diagnostic procedure to determine the healthiness of critical hardware components. Faults are reported via fault LED on the front plate.

DO card is EMI/EMC compliant as per standard IEC60870-2-1, Level 3.

PROCESSING FUNCTIONS

DOA00x can execute following processing functions on the output channels, depending upon the configuration:

- Double bit commands with automatic handling for latch outputs. Ensures that only one channel is triggered ON or OFF at any given time.
- Dedicated feedback monitoring for SBE commands via dedicated select and execute monitoring circuit. Detects hardware malfunctions and reports them to CPU
- Individual treatment of Pulse or latch per channel for non SBE command
- Feedback monitoring for pulse commands
- Pulse train with minimum duration of 50 ms.

Processing on the card is carried out by the on board microcontroller. The card communicates with the CPU over 1 Mbps CAN bus. Configuration data is received from CPU and different processing functions are activated accordingly. Upon receiving commands from CPU, command is processed and appropriate processing functions are applied. If proper feedback is not received, error is reported to the CPU.
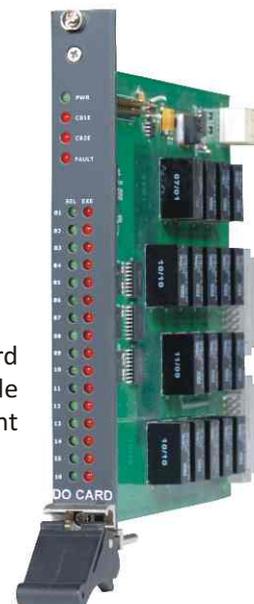
TECHNICAL SPECIFICATIONS

Processor	32 bit microcontroller
Points	16 / 8 Channels, 2 groups of 8, Potential Free Outputs
Isolation	1KV between field and system
Protection	Surge
Power Consumption	2.5W max
Operating Temperature	0-70 Degree C
Relative Humidity	95% non condensing
I/O Connections	2x20 pin pluggable connector on chassis backplane
Dimensions	4U high x 4T wide, 1 slot width

MODULE INDICATIONS

LED	Purpose
PWR	Indicates presence of input power
CB1E, CB2E	Error in backplane IO bus
FAULT	Indicates presence of critical fault in module
01 … 16	Output Status. ● Channel Selected. ● Channel Executed.

ORDERING INFORMATION

Order Code	Specifications
E70-DOA-001	16 Channels, Potential Free NO Contacts
E70-DOA-002	8 Channels, Potential Free NO Contacts

DIGITAL OUTPUT WIRING

0 V DC

R1 1 1	R2 2 2	R3 3 3	R4 4 4	R5 5 5	R6 6 6	R7 7 7	R8 8 8

24 VDC

R1(+)/DO1C−B1
R2(+)/DO1C−B2
R3(+)/DO1C−B3
R4(+)/DO1C−B4
R5(+)/DO1C−B5
R6(+)/DO1C−B6
R7(+)/DO1C−B7
R8(+)/DO1C−B8

24 VDC/DO1C−B9

DO1C−B1/R1(+)
DO1C−B2/R2(+)
DO1C−B3/R3(+)
DO1C−B4/R4(+)
DO1C−B5/R5(+)
DO1C−B6/R6(+)
DO1C−B7/R7(+)
DO1C−B8/R8(+)
DO1C−B9/24 VDC

IE
IE

DO1
C

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
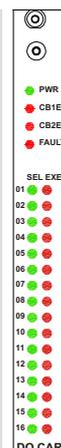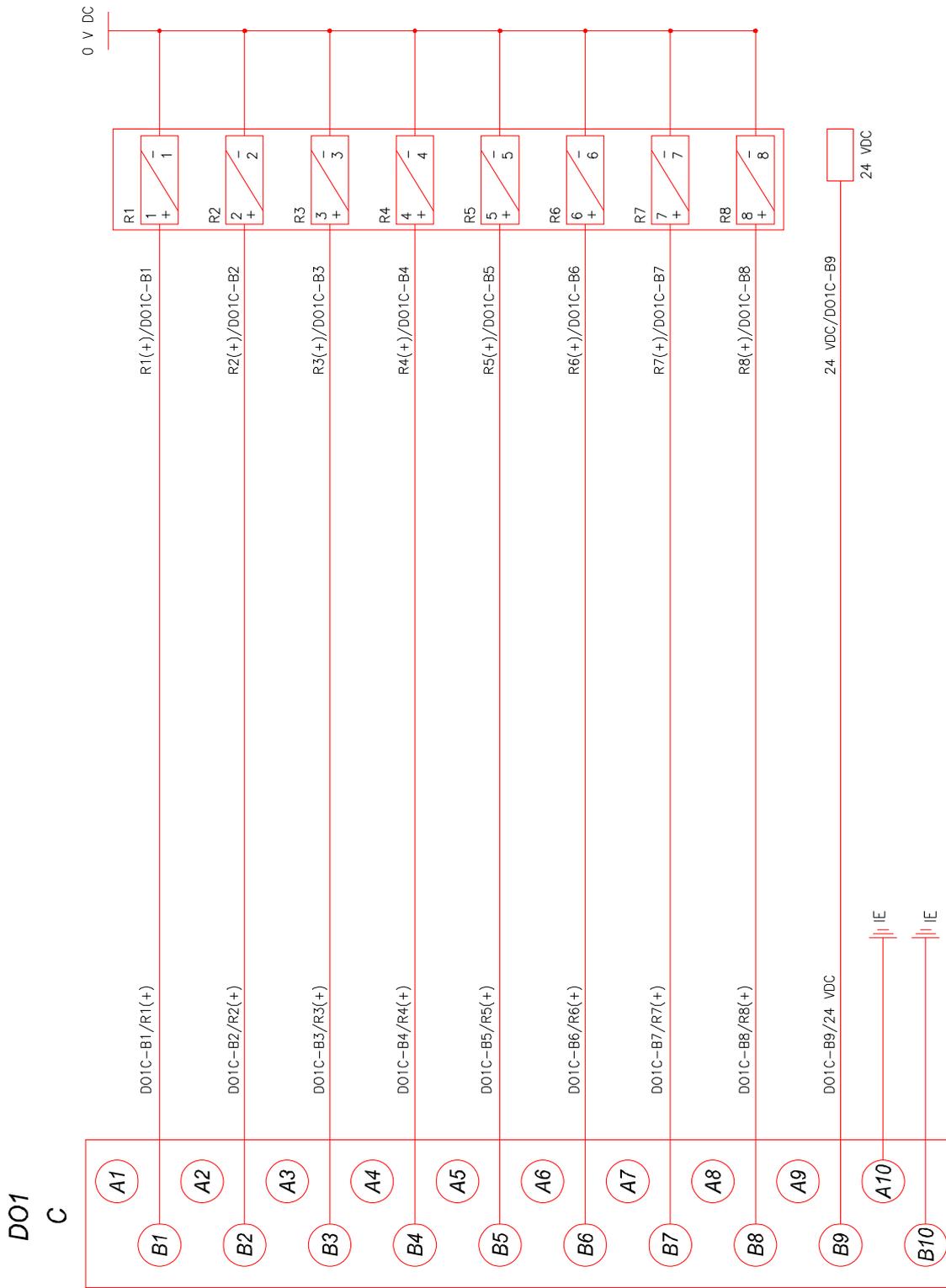
HUSKY™
6049-E70

AIB-00x, part of Husky series RTU, are multiple channel differential input analog cards with an onboard 32 bit microcontroller for scanning process inputs, independent of CPU. The modules have onboard memory to store calibration data, per channel, to compensate inaccuracies of circuit components. A dedicated *"Hot Swap Controller"* is present on the card to allow fail safe hot swapping of cards without affecting the backplane bus.

GENERAL TECHNICAL DESCRIPTION

AIB-00x analog input cards support differential ended, unipolar and bipolar 8/12/16 inputs. The inputs are galvanically isolated from system logic. With a 16 bit ADC (15 bit data and 1 sign bit), it provides accuracy of 0.1%. The onboard temperature sensor and a dedicated calibration circuit, allows the channels to be automatically calibrated to compensate errors due to temperature variations. "Out of Calibration" alarm is generated by the card if the variations in the readings are beyond compensation. Following additional functionalities are provided:

- Built-in 50/60 Hz rejection filter
- Automatic calibration
- Live Zero Monitoring
- Overload capacity of 150% of FSR

All input channels are protected against high voltage using suitable MOVs and fuses. AI card is EMI/EMC compliant as per standard IEC60870-2-1, Level 3.

When powered on, the card carries out a self diagnostic procedure to determine the healthiness of critical hardware components. Faults are reported via fault LED on the front plate.

PROCESSING FUNCTIONS

Voltage and current selection is achieved through jumpers provided for each channel. The card communicates with the CPU over 1 Mbps CAN bus. Configuration data is received from CPU and different processing functions are activated accordingly. Microcontroller also monitors the open circuits in case of 4-20mA range and reports the faults to the CPU via diagnostic data. Open circuit channels are reported as Invalid. Input data set is transmitted to CPU upon receiving a sideband signal. This allows card and CPU to follow "producer & consumer" approach of data exchange with bus control functionality handled by CPU.

TECHNICAL SPECIFICATIONS

|	
Processor	32 bit microcontroller
Channels	8 / 12 / 16 Differential Input Channels Individually selectable for voltage and current.
Voltage Inputs	0-10V DC 0-5V DC ± 10V DC ± 5V DC
Current Inputs	0-20mA 4-20mA ±20mA Install the channel jumper to enable current mode.
Input Counts	Unipolar: 0 – 32767 Bipolar: -32768 - +32767
Resolution	16 bit (15 bit data + 1 sign bit) both for inputs
Accuracy	0.1%
Input Impedance	Voltage Inputs: 1 MOhm nominal Current Inputs: 250 Ohm nominal
Isolation	Field & System 1500VDC Between Channels 500VDC
Protection	Surge & Overload
Power Consumption	2.5W max
Operating Temperature	0-70 Degree C
Relative Humidity	95% non condensing
I/O Connections	2x20 pin pluggable connector on chassis backplane
Dimensions	4U high x 4T wide, 1 slot width

LED INDICATIONS

LED	Purpose
PWR	Indicates presence of input power
CB1E, CB2E	Error in backplane IO bus
FAULT	Indicates presence of critical fault

ORDERING INFORMATION

Order Code	Specifications
E70-AIB-001	12 Voltage / Current Differential Channels
E70-AIB-002	16 Voltage / Current Differential Channels
E70-AIB-003	8 Voltage / Current Differential Channels

ANALOG INPUT WIRING

AI1

TB1

TB1 pin	Signal	Terminal connection
1	TB1-1/AI1C-A1(+)	AI1C-A1(+)/TB1-1
2	TB1-2/AI1C-B1(-)	AI1C-B1(-)/TB1-2
3	TB1-3/AI1C-A2(+)	AI1C-A2(+)/TB1-3
4	TB1-4/AI1C-B2(-)	AI1C-B2(-)/TB1-4
5	TB1-5/AI1C-A3(+)	AI1C-A3(+)/TB1-5
6	TB1-6/AI1C-B3(-)	AI1C-B3(-)/TB1-6
7	TB1-7/AI1C-A4(+)	AI1C-A4(+)/TB1-7
8	TB1-8/AI1C-B4(-)	AI1C-B4(-)/TB1-8
9	TB1-9/AI1C-A5(+)	AI1C-A5(+)/TB1-9
10	TB1-10/AI1C-B5(-)	AI1C-B5(-)/TB1-10
11	TB1-11/AI1C-A6(+)	AI1C-A6(+)/TB1-11
12	TB1-12/AI1C-B6(-)	AI1C-B6(-)/TB1-12
13	TB1-13/AI1C-A7(+)	AI1C-A7(+)/TB1-13
14	TB1-14/AI1C-B7(-)	AI1C-B7(-)/TB1-14
15	TB1-15/AI1C-A8(+)	AI1C-A8(+)/TB1-15
16	TB1-16/AI1C-B8(-)	AI1C-B8(-)/TB1-16

Not Connected

Not Connected

IE

IE

C

A1 B1 A2 B2 A3 B3 A4 B4 A5 B5 A6 B6 A7 B7 A8 B8 A9 B9 A10 B10

HUSKY™
6049-E70

Power Generation

Power Transmission & Distribution

Oil & Gas
Transmission & Distribution

Railway
Traction

AO CARD

AOA001, part of Husky series RTU, is a 4 channel analog output card with an onboard 32 bit microcontroller for controlling process outputs. Analog output card provides accuracy of 0.1%.

GENERAL TECHNICAL DESCRIPTION

AOA001 is a high performance analog output card that provides isolated outputs, for 4 process signals. With a 16 bit DAC (15 bit data and 1 sign bit), it provides accuracy of 0.1%. Following additional functionalities are provided:

- 4 Channel Output
- Selectable for Current and Voltage Inputs
- Live Zero Output

All output channels are individually isolated and protected against high voltage using suitable MOVs. Field and logic system are isolated using optical isolators to ensure maximum protection from field.

When powered on, the card carries out a self diagnostic procedure to determine the healthiness of critical hardware components. Faults are reported via fault LED on the front plate.

AO card is EMI/EMC compliant as per standard IEC60870-2-1, Level 3.

PROCESSING FUNCTIONS

AOA001 can provide following outputs depending upon the configuration:

- 4-20 mA
- 0-20 mA
- +20mA
- 0-10 VDC
- 0-5VDC
- +10VDC
- +5VDC

Voltage and current selection is achieved by shorting the jumpers provided for each channel. Processing on the card is carried out by the on board microcontroller. The card communicates with the CPU over 1 Mbps CAN bus. Configuration data is received from CPU and different processing functions are activated accordingly. Output command is received by microcontroller from the CPU, in every cycle and outputs are generated accordingly. Microcontroller also monitors the open circuits in case of 4 - 20mA range and reports the faults to the CPU via diagnostic data. Open circuit channels are reported as Invalid.

TECHNICAL SPECIFICATIONS

Processor	32 bit microcontroller
Points	4 Output Channels. Each point individually selectable for voltage and current.
Resolution	16 bit (15 data bits + 1 sign bit)
Accuracy	0.1% or better
Voltage Outputs	0-10V DC 0-5V DC +/- 10V DC +/- 5V DC Uninstall the channel jumper to enable voltage mode.
Current Outputs	0-20mA 4-20mA +/-20mA Install the channel jumper to enable current mode.
Output Characteristics	Voltage Outputs: Min 1 KOhm load Current Outputs: Loop compliance voltage 21V
Isolation	Field & System 1500VDC Between Channels 500VDC
Protection	Surge & Overload
Fault Alarms	Open Loop & Short Circuit
Power Consumption	2.5W max
Operating Temperature	0-70 Degree C
Relative Humidity	95% non condensing
I/O Connections	2x20 pin pluggable connector on chassis backplane
Dimensions	4U high x 4T wide, 1 slot width

LED INDICATIONS

LED	Purpose
PWR	Indicates presence of input power
CB1E, CB2E	Error in backplane IO bus
FAULT	Indicates presence of critical fault

PWR
CB1E
CB2E
FAULT

AO CARD

ORDERING INFORMATION

Order Code	Specifications
E70-AOA-001	4 Voltage / Current Output Channels

ANALOG OUTPUT WIRING

	TB1	
AO1(+)	1	TB1-1/AO1C-A1(+)
AO1(−)	2	TB1-2/AO1C-B1(−)
AO2(+)	3	TB1-3/AO1C-A3(+)
AO2(−)	4	TB1-4/AO1C-B3(−)
AO3(+)	5	TB1-5/AO1C-A5(+)
AO3(−)	6	TB1-6/AO1C-B5(−)
AO4(+)	7	TB1-7/AO1C-A7(+)
AO4(−)	8	TB1-8/AO1C-B7(−)

AO1
C

Terminal	Wire	Function
A1	AO1C-A1(+)/TB1-1	
B1	AO1C-B1(−)/TB1-2	
A3	AO1C-A3(+)/TB1-3	
B3	AO1C-B3(−)/TB1-4	
A5	AO1C-A5(+)/TB1-5	
B5	AO1C-B5(−)/TB1-6	
A7	AO1C-A7(+)/TB1-7	
B7	AO1C-B7(−)/TB1-8	
A2		Not Connected
B2		Not Connected
A4		Not Connected
B4		Not Connected
A6		Not Connected
B6		Not Connected
A8	AO1C-A9/0 VDC	0 VDC/AO1C-A9 0V DC
B8	AO1C-B9/24 VDC	24 VDC/AO1C-B9 +24V DC
A9		Not Connected
B9		Not Connected
A10		IE
B10		IE

HUSKY™
6049-E70

AXA-001, part of Husky series RTU, is a 4 channel mixed analog input and output card. It has an onboard 32 bit microcontroller for scanning process inputs and maintaining process outputs. On board memory is available to store calibration data, per input channel, to compensate and accommodate inaccuracies of circuit components. The card provides accuracy of 0.1% for both input and output channels. A dedicated "Hot Swap Controller" is present on the card to allow fail safe hot swapping of cards without affecting the backplane bus.
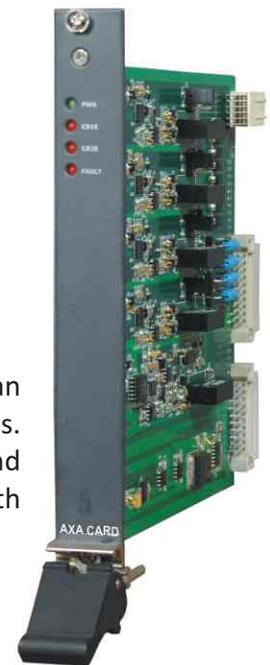
GENERAL TECHNICAL DESCRIPTION

AXA-001 is a high performance analog input and output card that provides 4 current / voltage differential input bipolar channels and 4 voltage / current bipolar output channels. With a 16 bit (15 bit data and 1 sign bit) ADC for process inputs and 16 bit (15 bit data and 1 sign bit) DAC for process outputs, it provides accuracy of 0.1% for both input & output channels. Following additional functionalities are provided:

❍ Built in 50/60 Hz built in rejection filter for inputs

❍ Live Zero Monitoring for both input and output

❍ Overload capacity of 150% of FSR

All input and output channels are protected against high voltage using suitable MOVs and fuses. Both input and output channels are galvanically isolated from system logic. When powered on, the card carries out a self diagnostic procedure to determine the healthiness of critical hardware components. Faults are reported via fault LED on the front plate.

Mixed analog card is EMI/EMC compliant as per standard IEC60870-2-1, Level 3.

PROCESSING FUNCTIONS

Voltage and current selection is achieved by shorting the jumpers provided for each channel. Processing on the card is carried out by the on board microcontroller. The card communicates with the CPU over 1 Mbps CAN bus.

The data is scanned by microcontroller at regular intervals and appropriate processing functions are applied. Microcontroller also monitors the open circuit in case of 4-20mA range and reports the faults to the CPU via diagnostic data. Open circuit channels are reported as Invalid.

Output commands are received by microcontroller from the CPU, in every cycle and outputs are generated accordingly. Microcontroller also monitors the open circuits in case of 4 -20mA output range and short circuit for all supported ranges. Faults are reported to the CPU via diagnostic data. Open circuit / short circuit output channels are reported as Invalid.

TECHNICAL SPECIFICATIONS

Processor	32 bit microcontroller			
Channels	4 bipolar differential input channels.			
	4 bipolar output channels.			
	Channel individually selectable for voltage & current.			
Voltage Inputs	0-10V DC	0-5V DC		
	$\pm$ 10V DC	$\pm$ 5V DC		
Current Inputs	0-20mA	4-20mA	$\pm$20mA	
	Install the channel jumper to enable current mode.			
Voltage Outputs	0-10V DC	0-5V DC		
	$\pm$ 10V DC	$\pm$ 5V DC		
Current Outputs	0-20mA	4-20mA	$\pm$20mA	
	Install the channel jumper to enable current mode.			
Input Counts	Unipolar: 0 – 32767			
	Bipolar: -32768 - +32767			
Output Counts	Unipolar: 0 – 32767			
	Bipolar: -32768 - +32767			

Resolution	16 bit (15 bit data + 1 sign bit) both for inputs & outputs
Accuracy	0.1% for both inputs and outputs
Field Supply	24VDC for analog outputs
Input Impedance	Voltage Inputs: 1 MOhm nominal
	Current Inputs: 250 Ohm nominal
Output Load Characteristics	Voltage Output: > 1 kOhm
	Current Output: < 1 kOhm
Isolation	Field & System 1500VDC
	Between Channels 500VDC
Protection	Surge & Overload
Power Consumption	2.5W max
	< 4W for +24VDC field power
Operating Temperature	0-70 Degree C
Relative Humidity	95% non condensing
I/O Connections	2x20 pin pluggable connector on chassis backplane
Dimensions	4U high x 4T wide, 1 slot width

LED INDICATIONS

LED	Purpose
PWR	Indicates presence of input power
CB1E, CB2E	Error in backplane IO bus
FAULT	▬ Presence of critical fault
	▭ Missing field power for AO
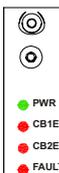
ORDERING INFORMATION

Order Code	Specifications
E70-AXA-001	4 Voltage/Current bipolar differential inputs
	4 Voltage /Current bipolar outputs

PWR
CB1E
CB2E
FAULT

AXA CARD

HUSKY™
6049-E70

Power Generation

Power Transmission & Distribution

Oil & Gas
Transmission & Distribution

Railway
Traction

PSU-00x modules are rack power supply units for providing power over the backplane to different modules installed in the rack. PSU-00x accept wide range input from 18 to 60VDC to accommodate 24V and 48V DC sources.

GENERAL TECHNICAL DESCRIPTION

PSU-00x provides 5VDC output to the cards through the backplane. The onboard potentiometer on the module allows the output to be varied by +5%. Built in reverse polarity protection and short circuit protection provides adequate safety. A power supply failure relay contact is also provided which can be used for alarm annunciation or can be wired to a digital input of the RTU. The modules offer excellent line and load regulation for stable operation of the RTU under different input/load conditions.

Redundancy (parallel operation) function is also available as an option in PSU-00x. This allows for installation two power supplies in the same rack for parallel operation. The two modules can be powered from different sources for a fully redundant power solution.

The PSU module conforms to IEC61000-4-29 (Voltage Dips and Interrupts) and can operate without affecting the output, for voltage dips of -

30% for 0.1s,   60% for 0.1s,   100% for 0.05s

TECHNICAL SPECIFICATIONS

	E70-PSU-001	E70-PSU-002
Input Voltage	18-60 VDC	
Inrush Current	15A	8A
Max Input Current	4A @ 18VDC	2A @ 18VDC
Output Voltage	5VDC	
Output Adjustment	+5% of output	
Output Current	12A @ 5VDC	6A @ 5VDC
Line Regulation	5mV Max	
Load Regulation	5mV Max	
Ripple	20 mV RMS	
Isolation	1 KV galvanic isolation between Input & Output	
Protection	Over voltage	
	Under voltage	
	Short Circuit	
	Reverse Polarity	
	EN 55022 Class B Filter	
Indications	3 Pin screw terminal for PSU fail contact (1 NO + 1 NC)	
Operating Temperature	0-70 Deg C	
Relative Humidity	95% non condensing	
Dimensions	4U high x 6T wide	

LED INDICATIONS

LED	Purpose
DC IN	Input Supply Present
DC OUT	Output ON Indication
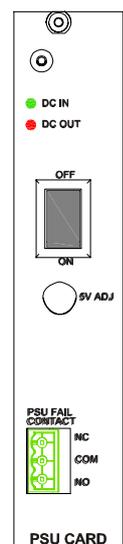
ORDERING INFORMATION

Order Code	Specifications
E70-PSU-001	60 W
E70-PSU-002	30 W
Add -R suffix for redundancy option	

HUSKY™ 6049-E70

- ❍ Suitable for 19"-wide, 4U Rack
- ❍ 16x I/O Slots
- ❍ 2x PSU Slots
- ❍ 4x CXM / SPM Slots
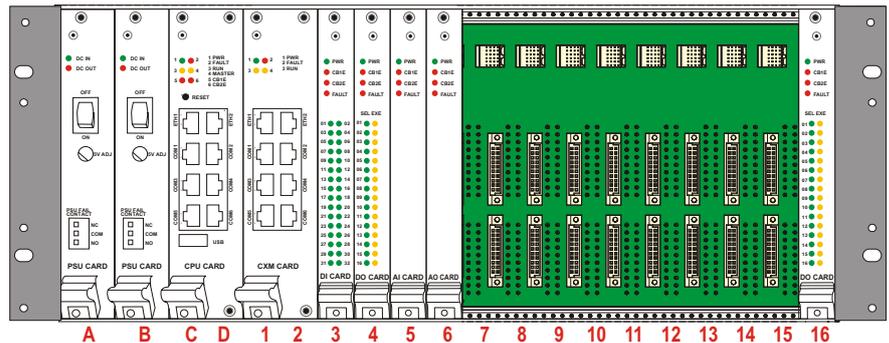
GENERAL TECHNICAL DESCRIPTION

The E70-CHS-001 chassis of HUSKY RTU 6049-E70, in conjunction with E70-RCK-001, provides for a standard 19"- rack mountable solution for the RTU with 16x I/O slots, 2x PSU Slots. This chassis supports installation of either a CPU module for use as a processor rack, or an IOS module for use as an I/O rack.

When used as a processor rack, four slots are available for use by CXM/SPM modules.

CHARACTERISTICS

- ❍ Fits into standard 19"-wide racks
- ❍ Maximum of 16 I/O modules per chassis
- ❍ Maximum of 2 Power Supply modules per chassis
- ❍ Maximum of 1 CPU / 1 IOS module per chassis
- ❍ Maximum of 4 CXM/SPM modules per chassis
- ❍ Interconnection of racks for expanded I/O configurations
- ❍ Pluggable Molex connectors at rear for field I/O termination
- ❍ EMI/EMC Compatible

CONNECTIONS

Power Supply	
X1 (Main)	3-pole Screw Terminal
X2 (Redundant)	3-pole Screw Terminal
Time Synchronization Pulse Input	
X5	2-pole Screw Terminal
Expansion Bus Connections	
X3, X4	2x DB9 Female Connectors
Process I/O Connections	
X7..X38	20-pin Pluggable Molex Connectors

SLOT ALLOCATIONS

Slot A,B	Power Supply Unit
Slot C-D	CPU Module Or, IOS Module (Slot C)
Slot 1-2	CXM/SPM Module #1 Or, I/O Module #1, #2
Slot 3-4	CXM/SPM Module #2 Or, I/O Module #3, #4
Slot 5-6	CXM/SPM Module #3 Or, I/O Module #5, #6
Slot 7-8	CXM/SPM Module #4 Or, I/O Module #7, #8
Slot 9..16	I/O module #9..#16

DIMENSIONS

426.72mm (W) x 172mm (H) {4U x 84T}
Depth with cards inserted 210mm

1U = 44.45mm
1T = 5.08mm

ENVIRONMENTAL CONDITIONS

Operating Temperature: 0-70°C
Humidity: 5-95% RH

ORDERING INFORMATION

Order Code	Specifications
E70-CHS-001	RTU chassis for 19" racks (16x I/O Slots)
E70-RCK-001	RTU sub-rack for 19" racks

BACKPLANE CONNECTORS
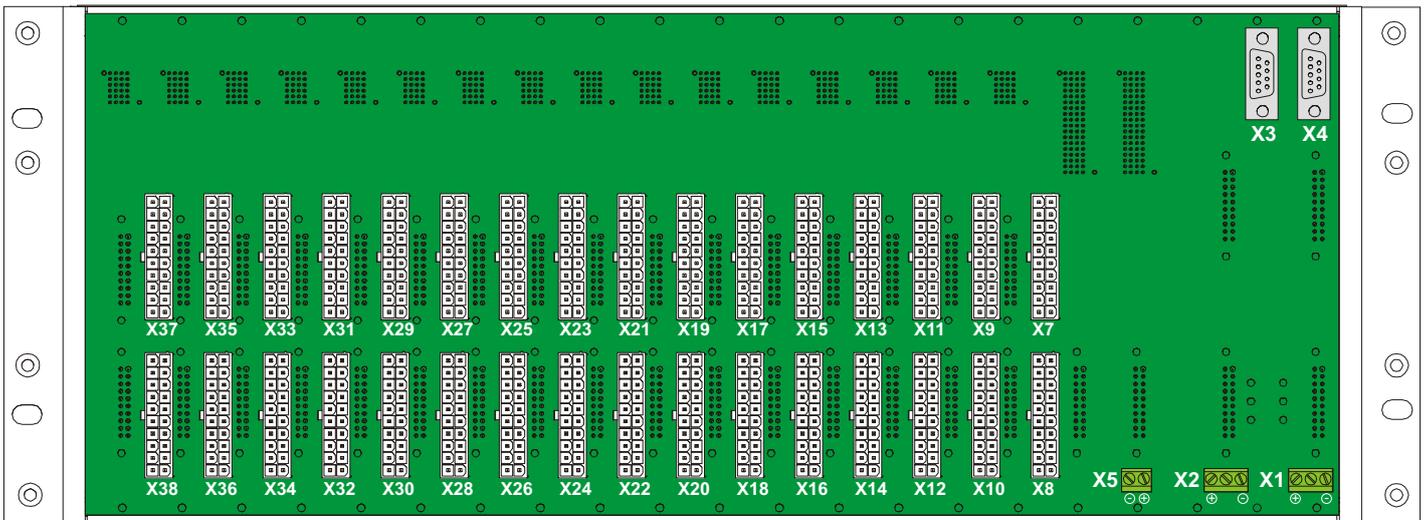
PROCESS I/O CONNECTOR DETAIL

HUSKY™
6049-E70

Power Generation

Power Transmission & Distribution

Oil & Gas
Transmission & Distribution

Railway
Traction
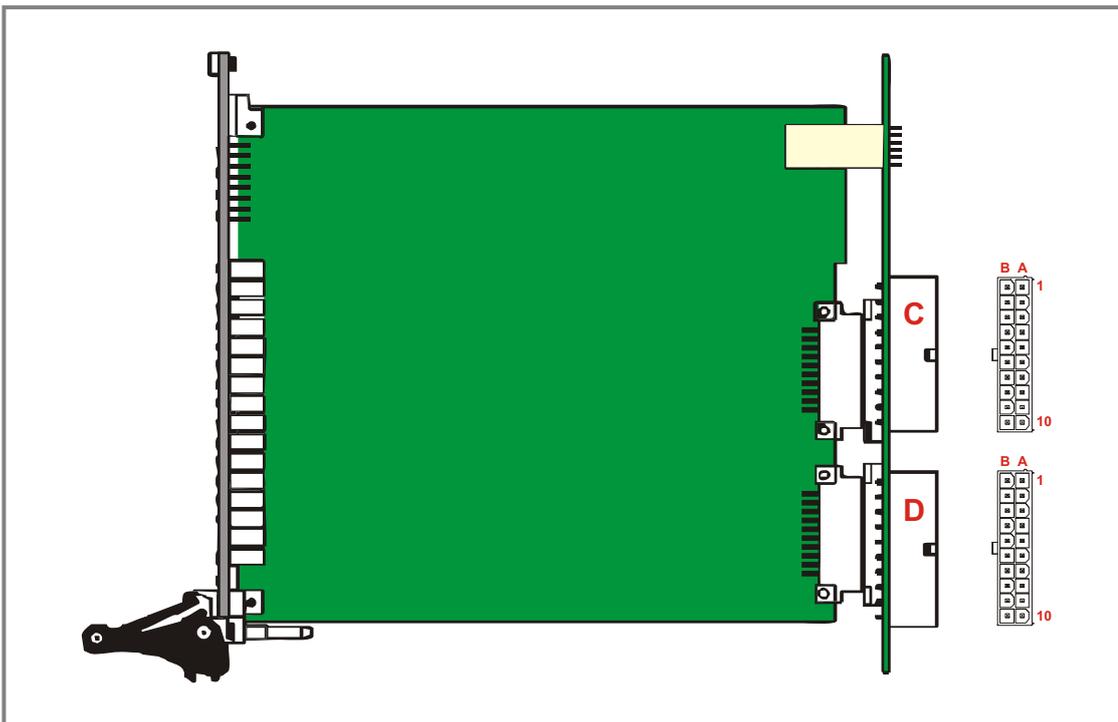
- Suitable for half-width 19", 4U Rack
- 5x I/O Slots
- 2x PSU Slots
- 1x CPU Slot
- 2x CXM / SPM Slots

GENERAL TECHNICAL DESCRIPTION

The E70-CHS-002 chassis of HUSKY RTU 6049-E70, in conjunction with E70-RCK-002, provides for a half-width 19"- rack mountable solution for the RTU with 5x I/O slots, 2x PSU Slots. This chassis supports installation of either a CPU module for use as a processor rack, or an IOS module for use as an I/O rack.

When used as a processor rack, two slots are available for use by CXM/SPM modules.

Two E70-CHS-002 can be installed inside a single E70-RCK-001. Redundant processor configurations can be achieved using this arrangement.

CHARACTERISTICS

- Half-width 19"-wide racks
- Maximum of 5 I/O modules per chassis
- Maximum of 2 Power Supply modules per chassis
- Maximum of 1 CPU / 1 IOS module per chassis
- Maximum of 2 CXM/SPM modules per chassis
- Interconnection of racks for expanded I/O configurations
- Pluggable Molex connectors at rear for field I/O termination
- EMI/EMC Compatible

CONNECTIONS

Power Supply	
X1 (Main)	3-pole Screw Terminal
X2 (Redundant)	3-pole Screw Terminal
Time Synchronization Pulse Input	
X5	2-pole Screw Terminal
Expansion Bus Connections	
X3, X4	2x DB9 Female Connectors
Process I/O Connections	
X7..X16	20-pin Pluggable Molex Connectors
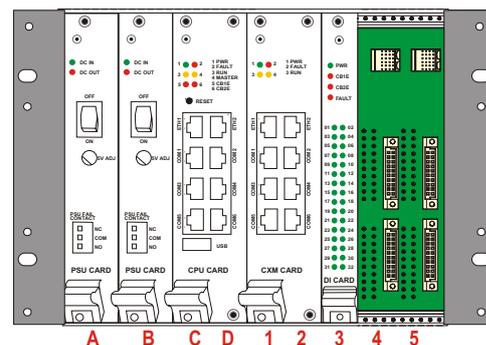
SLOT ALLOCATIONS

Slot A,B	Power Supply Unit
Slot C-D	CPU Module
	Or, IOS Module (Slot C)
Slot 1-2	CXM/SPM Module #1
	Or, I/O Module #1, #2
Slot 3-4	CXM/SPM Module #2
	Or, I/O Module #3, #4
Slot 5	I/O module #5

DIMENSIONS

203.2mm (W) x 172mm (H) {4U x 84T}
Depth with cards inserted 210mm

1U = 44.45mm
1T = 5.08mm

ENVIRONMENTAL CONDITIONS

Operating Temperature: 0-70°C
Humidity: 5-95% RH

ORDERING INFORMATION

| Order Code	Specifications
E70-CHS-002	RTU chassis (5x I/O Slots)
E70-RCK-002	RTU sub-rack for half-width 19" racks
E70-RCK-001	RTU sub-rack for 19" racks

BACKPLANE CONNECTORS
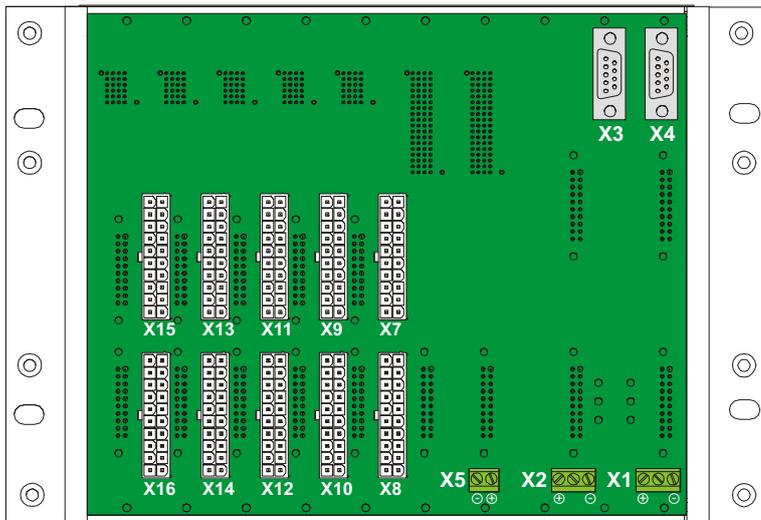
PROCESS I/O CONNECTOR DETAIL
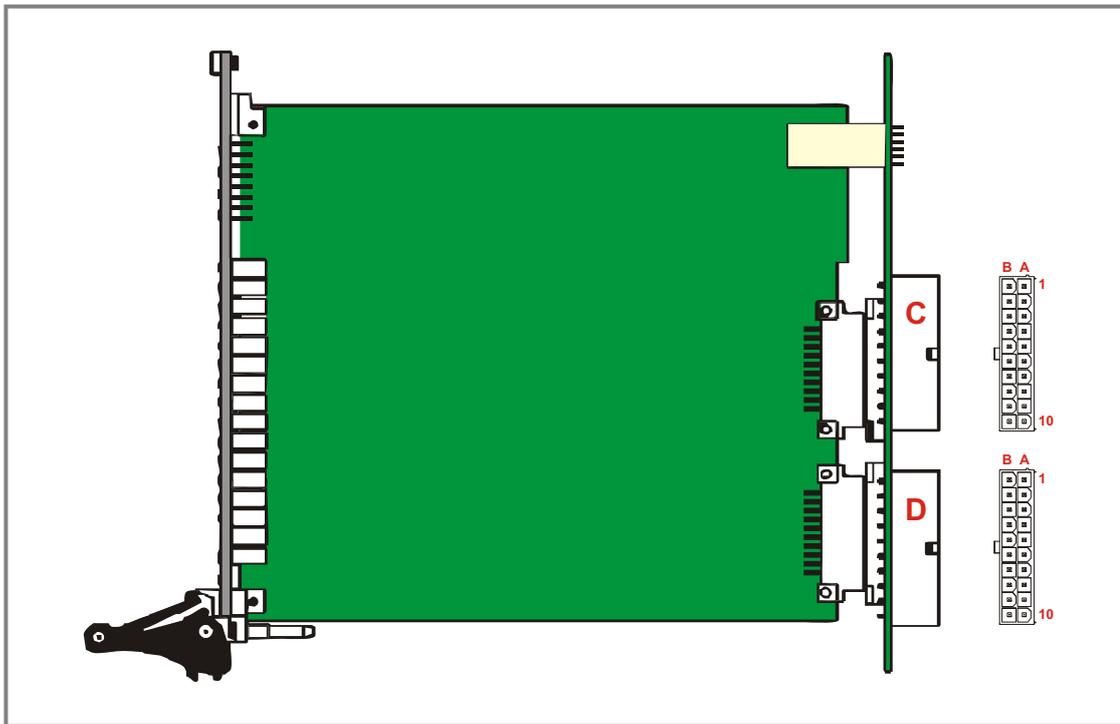
REDUNDANT PROCESSORS IN E70-RCK-001
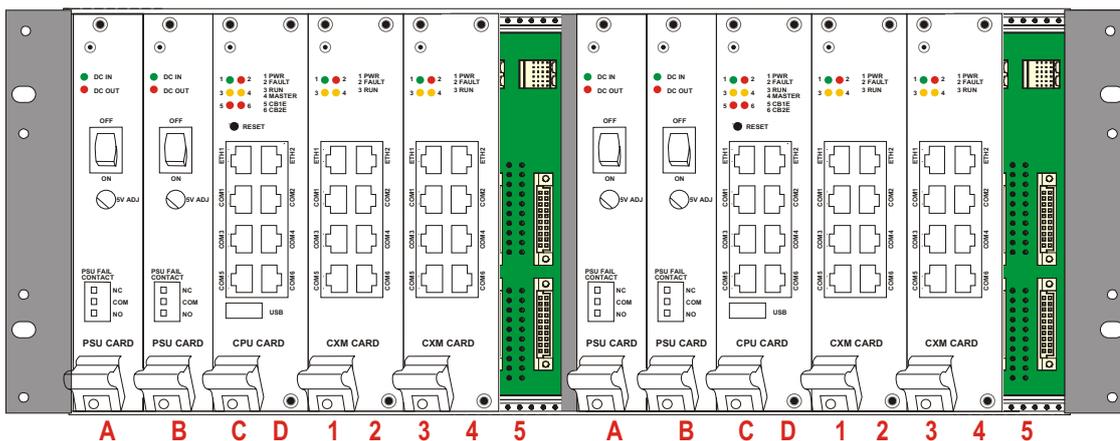
HUSKY™
6049-E70

- ❍ Suitable for 19"-wide, 4U Rack
- ❍ 15x I/O Slots
- ❍ 2x PSU Slots
- ❍ 2x CPU Slots
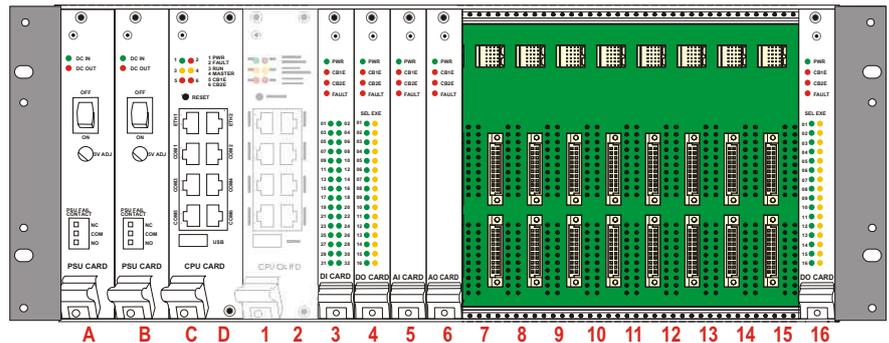
GENERAL TECHNICAL DESCRIPTION

The E70-CHS-005 chassis of HUSKY RTU 6049-E70, in conjunction with E70-RCK-001, provides for a standard 19"- rack mountable solution for the RTU with 15x I/O slots, 2x PSU Slots. This chassis supports installation of either two CPU modules in redundant fashion, with up to 15 I/O slots.

When redundant CPU module is installed, 14 I/O slots are available.

CHARACTERISTICS

- ❍ Fits into standard 19"-wide racks
- ❍ Maximum of 15 I/O modules per chassis
- ❍ Maximum of 2 Power Supply modules per chassis
- ❍ Maximum of 2 CPU modules per chassis
- ❍ Interconnection of racks for expanded I/O configurations
- ❍ Pluggable Molex connectors at rear for field I/O termination
- ❍ EMI/EMC Compatible

SLOT ALLOCATIONS

Slot A,B	Power Supply Unit
Slot C-D	CPU Module #1 Or, IOS Module (Slot C)
Slot 1-2	CPU Module #2 Or, I/O Module #2 (Slot 2)
Slot 3..16	I/O module #3..#16

DIMENSIONS

426.72mm (W) x 172mm (H) {4U x 84T}
Depth with cards inserted 210mm

1U = 44.45mm
1T = 5.08mm

ENVIRONMENTAL CONDITIONS

Operating Temperature: 0-70°C
Humidity: 5-95% RH

CONNECTIONS

Power Supply	
X1 (Main)	3-pole Screw Terminal
X2 (Redundant)	3-pole Screw Terminal
Time Synchronization Pulse Input	
X5	2-pole Screw Terminal
Expansion Bus Connections	
X3, X4	2x DB9 Female Connectors
Process I/O Connections	
X9..X38	20-pin Pluggable Molex Connectors

ORDERING INFORMATION

| Order Code	Specifications
E70-CHS-005	RTU chassis for 19" racks (2x CPU, 15x I/O Slots)
E70-RCK-001	RTU sub-rack for 19" racks

BACKPLANE CONNECTORS

PROCESS I/O CONNECTOR DETAIL

MOUNTING ARRANGEMENT

FRONT VIEW

REAR VIEW

VIEW-X

DETAIL A

DETAIL B

HOLE Ø4.2
CSK Ø8.0
8NOS

IO CONNECTOR

PPS/PPM PULSE INPUT

POWER SUPPLY

Panel Cutout Details

C

179.5

101.62

39.76

10.6

445.0

10.6
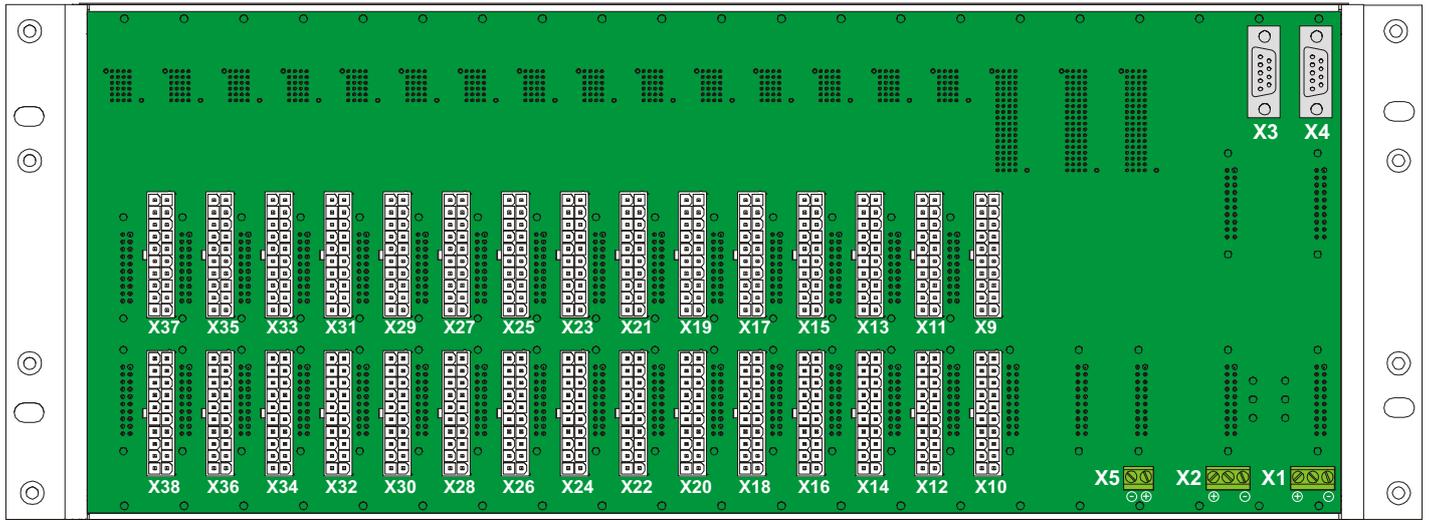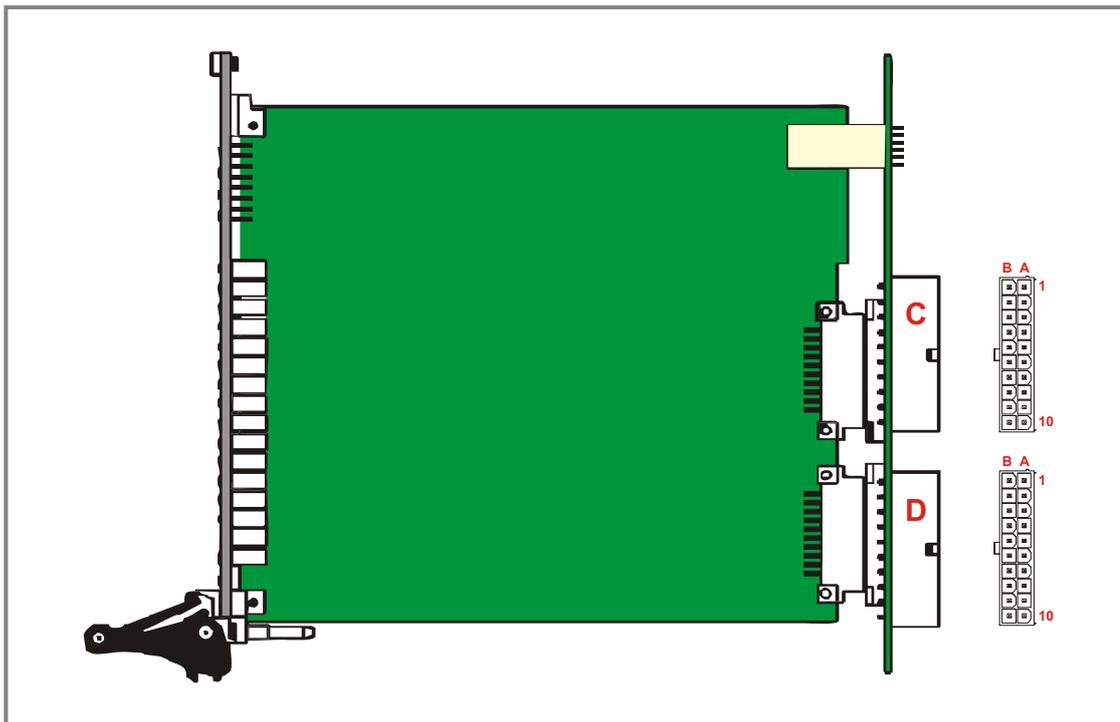
FOR RACK CUTOUT SIZE ON MOUNTING SURFACE

10.3

R3.4

6.8

HOLE Ø4.2 CSK Ø8.0
8NOS

DETAIL C
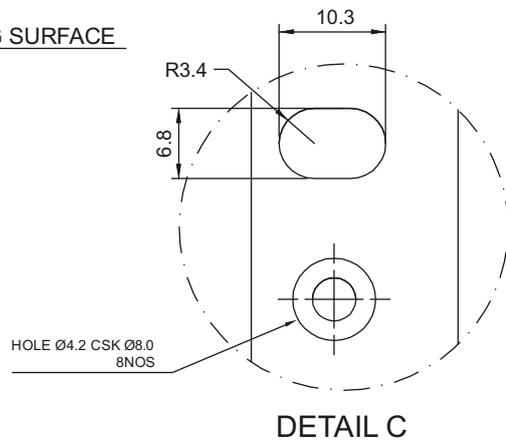
Isometric View
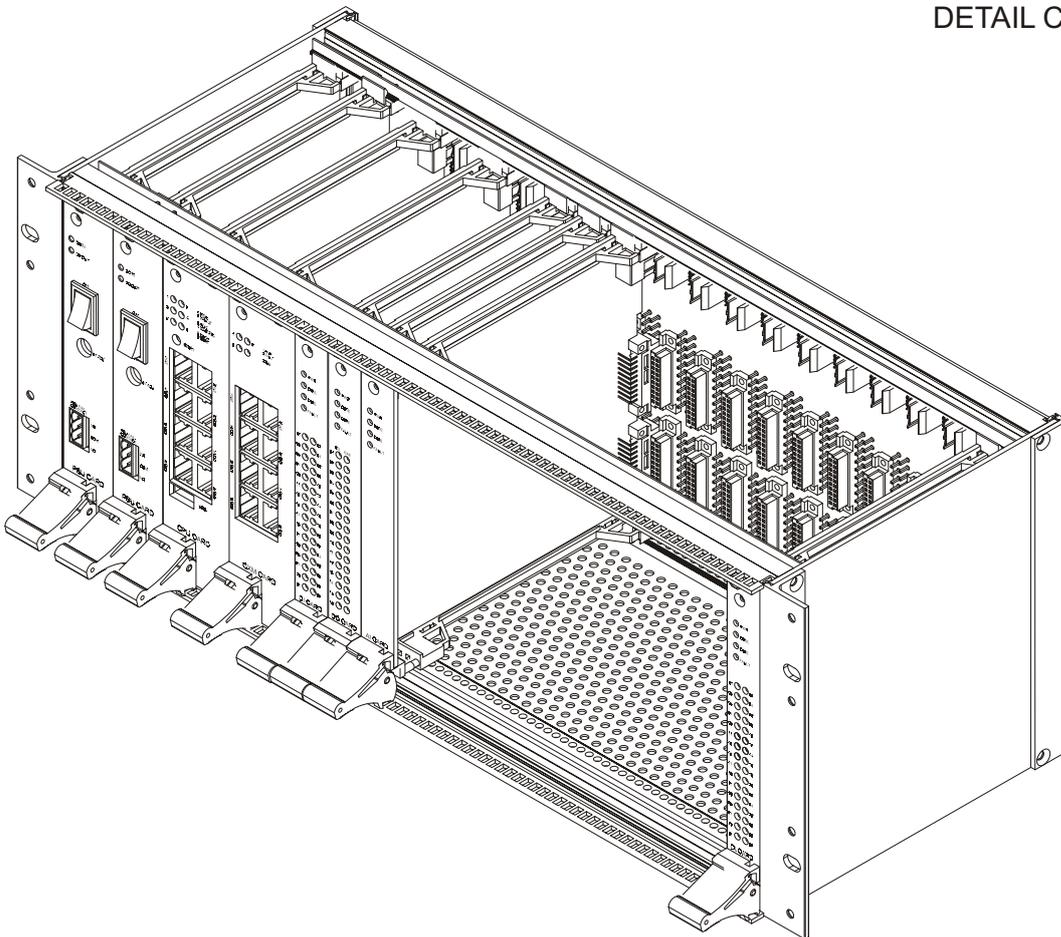
Terms & Abbreviations

ADC	Analog-Digital Converter
AI	Analog Input
AO	Analog Output
ARCNet	Attached Resource Computer NETwork
BCD	Binary Coded Decimal
CAN	Controller Area Network
CHS	RTU Chassis
CPU	Central Processing Unit
CXM	Communication Extender Module
DAC	Digital-Analog Converter
DI	Digital Input
DO	Digital Output
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Immunity
ESD	Electro-static Discharge
FO	Fiber Optic
FPGA	Field Programmable Gate Array
FSR	Full-Scale Reading
GPRS	General Packet Radio Service
GPS	Global Positioning System
IEC	International Electrotechnical Commission
IED	Intelligent Electronic Device
IEEE	Institute of Electrical and Electronic Engineers
IOS	I/O Scanner Module
LAN	Local Area Network
LON	Local Operating Network
MFT	Multi-function Transducer
NVRAM	Non-volatile RAM
PCB	Printed Circuit Board
PLC	Programmable Logic Controller
PPM	Parts-per-Million
PPS	Pulse-per-Second
PSU	Power Supply Unit
ROC	Rate of Change
RTC	Real-Time Clock
RTOS	Real-time Operating System
RTU	Remote Terminal Unit
SBE	Select-Before Execute
SCADA	Supervisory Control and Data Acquisition
SNMP	Simple Network Management Protocol
SNTP	Simple Network Time Protocol
SOE	Sequence of Events
SPM	Specialty Module
TCP	Transmission Control Protocol

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