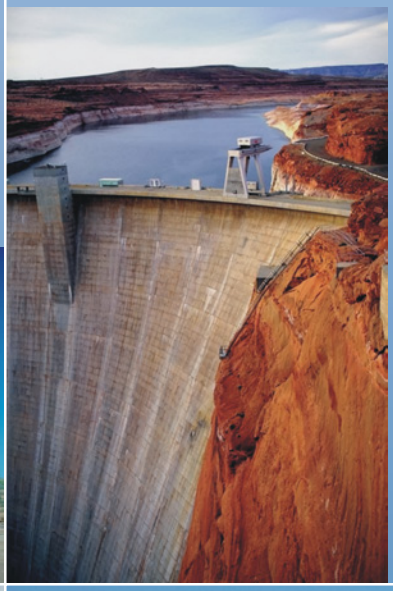


RUGID

RUG5/RUG9 APPLICATIONS

WATER SYSTEM TELEMETRY

Tank sites
Filter plants
Booster stations
Pump controls
Lake and stream monitoring

INDUSTRIAL

Process monitoring
Gas leak detection
Test monitoring
Alarm monitoring
Process control

WASTEWATER SYSTEM TELEMETRY

Lift stations
Treatment plants
Pump controls
Effluent monitoring
Chemical feeds

SHIP MONITORING

Mothball fleet
Intrusion alarms
Flood alarms
Fire alarms

PETROLEUM SYTEMS

Wellhead safety
Tank farms
Gas flow
Fuel level/flow
Spill detection

IRRIGATION SYSTEMS

Remote pump control
Alarm monitoring
Pivot control

WEATHER MONITORING

Flash flood warning
Snowpack monitoring
Reservoir levels
Stream flows
ALERT or 2-way
Cloud seeding

SECURITY SYSTEMS

Prisons
Autodialers
Intrusion monitoring

CANALS

Flow rates
Gate position
Valve control

DAM SAFETY

Flood warning
Dam integrity
Inflow/outflow monitoring
Gate position

TYPICAL SYSTEM

SCADA MASTER

RUG9 provides interface between SCADA master and field RTU's. Provides local I/O and does speech autodialing.

RUG9 uses Modbus RTU protocol to interface with compatible SCADA software including*:

AIMAX	Genesis
Citect	Outlook
EVENTS	Onspec
FactoryLink	ScadaLite
Fix	Scadavu
	Wonderware

EVENTS* screen shown courtesy of Roper Associates

RTU 1

RTU 2

Peer to peer communications

RTU 3

RTU 4

Store and forward site

RTU 5

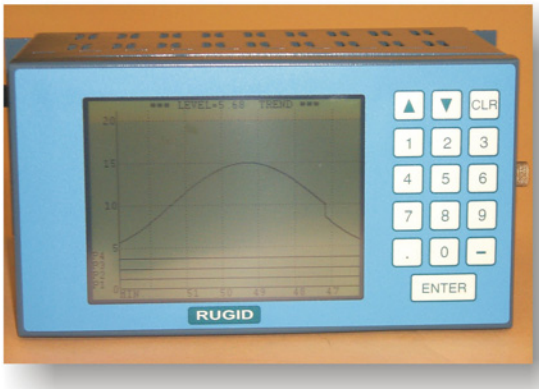
RTU 6- RUG9 model shown

REMOTE RTU

Typically, RUG5 or RUG9 RTU is mounted on backpan in vandal resistant, weatherproof enclosure. RTU performs local controls, detects alarms, maintains site statistics, and provides local operator interface. It uses its phone line or radio interface to report alarms, statuses and analog values to other sites including the master. It can communicate peer to peer with other RTU's and can act as an intermediary site in store and forward communications. Communications can be polled or quiescent report by exception.

*Names shown are copyrighted by their respective manufacturers

RUG9 KEY FEATURES



FLEXIBLE LCD DISPLAY

Swing out LCD can show trends, bargraphs, timetagged event logs, realtime data, setpoints,etc. LCD/keyboard module can be mounted up to 5 feet from card cage. 20 X 40 characters and graphics, 6" diagonal.

LONG DESIGN LIFE

Fast 32 bit microprocessor has large address space. Operating system and user configuration file can be field loaded into flash memory, eliminating obsolescence.

MODULAR DESIGN

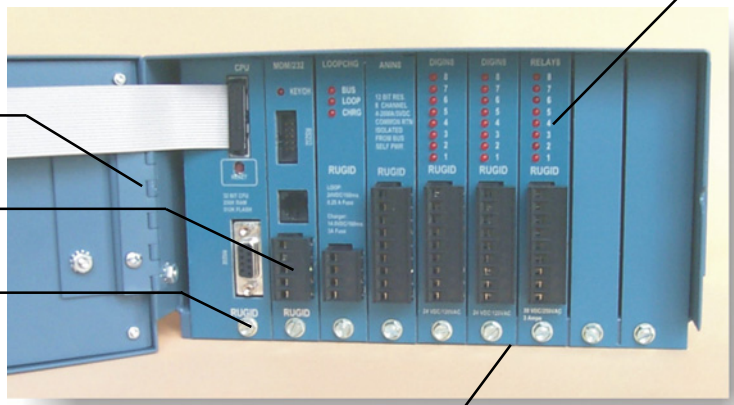
Slide in cards enable easy customization with choices of modem, serial ports, printer port, dialer, loop supply, optically isolated I/O, compact flash, etc...see page 7.

EASY MAINTENANCE

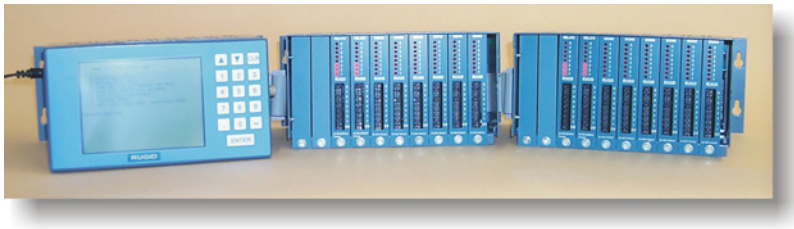
Removable display swings left for access to slide in cards.

Rising cage clamp type screw headers can be removed without removing individual wires. Can accept 14 ga. wires.

Cards can be replaced by removing a single screw.



Sturdy 16 ga. powder coated card cage provides noise shielding.



EXPANDABLE DESIGN

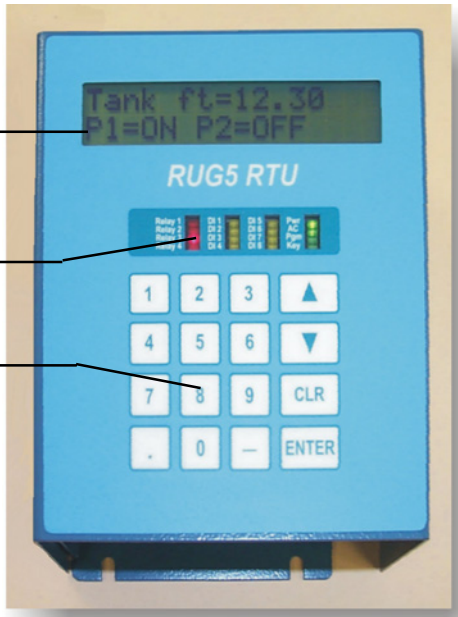
Up to 7 card cages can be connected to main cage to expand to as many as 512 I/O points.

RUG9/RUG5 MAIN FEATURE COMPARISON

FEATURE	RUG9D	RUG5AMDL1
CPU, Flash, RAM	32 bit, 512K, 256K battery backed	32 bit, 512K, 256K battery backed
Display	20X40 char/320X240 graphic	2X16 char
Keyboard	16 key tactile sealed	16 key tactile sealed
Modem	300/1200 baud audio, RS232	300/1200 baud audio, RS232
Loop power supply	24 VDC isolated 160 ma.	24 VDC isolated 160 ma.
Built in diagnostics	Temp, busV, battV, AC fail, low batt V	AC pwr fail, batt V, low batt V
Analog inputs	8, 4-20 ma/0-5V, 12 bit	4, 4-20 ma/0-5V, 12 bit
Analog outputs	None	None
Digital inputs	16	8
Relay outputs	8, 3 amp	4, 10 amp
Expansion slots	2, any RUG9 expansion card	2, any RUG9 expansion card
Additional expansion slots	56, any AI,DI,AO,DO,Combo card	None

RUG5 KEY FEATURES

RUG5 Top View



OPERATOR INTERFACE

Built in operator interface uses familiar prompts and engineering units display, eliminating operator guesswork or code memorization.

Front mounted LED's present digital I/O status and operating status.

Sealed tactile keyboard enables setpoint and mode changing.

RUG5 Front View

CPU and EXPANSION I/O

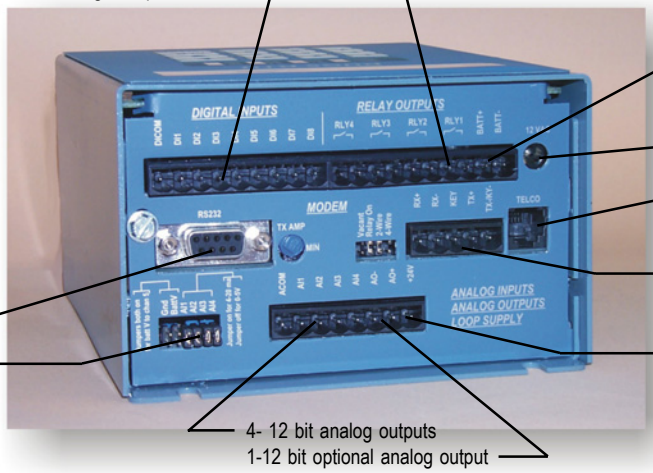
32 bit CPU board slides in from front, has 256K battery backed RAM and 512K flash. Unit programs the same as the RUG9. Operating system can be field upgraded using software available at no charge from our web site.

CPU can be connected to large RUG9 display module.

Two vacant expansion slots accept any RUG9 expansion boards.

Small 16 ga. powder coated steel enclosure (6.5 X 5 X 3.3 in.) mounts easily on backpan.

RUG5 Rear View



8 digital inputs

4- 10 amp relay outputs

Battery charger

12 VAC power

2-wire dialup telco jack

Radio/lease line connections

24VDC isolated 160 ma. loop supply

4- 12 bit analog outputs
1-12 bit optional analog output

RS232 port

4-20 ma/0-5V jumpers

BASE I/O

Rear panel provides easy access to I/O using removable rising cage type screw headers.

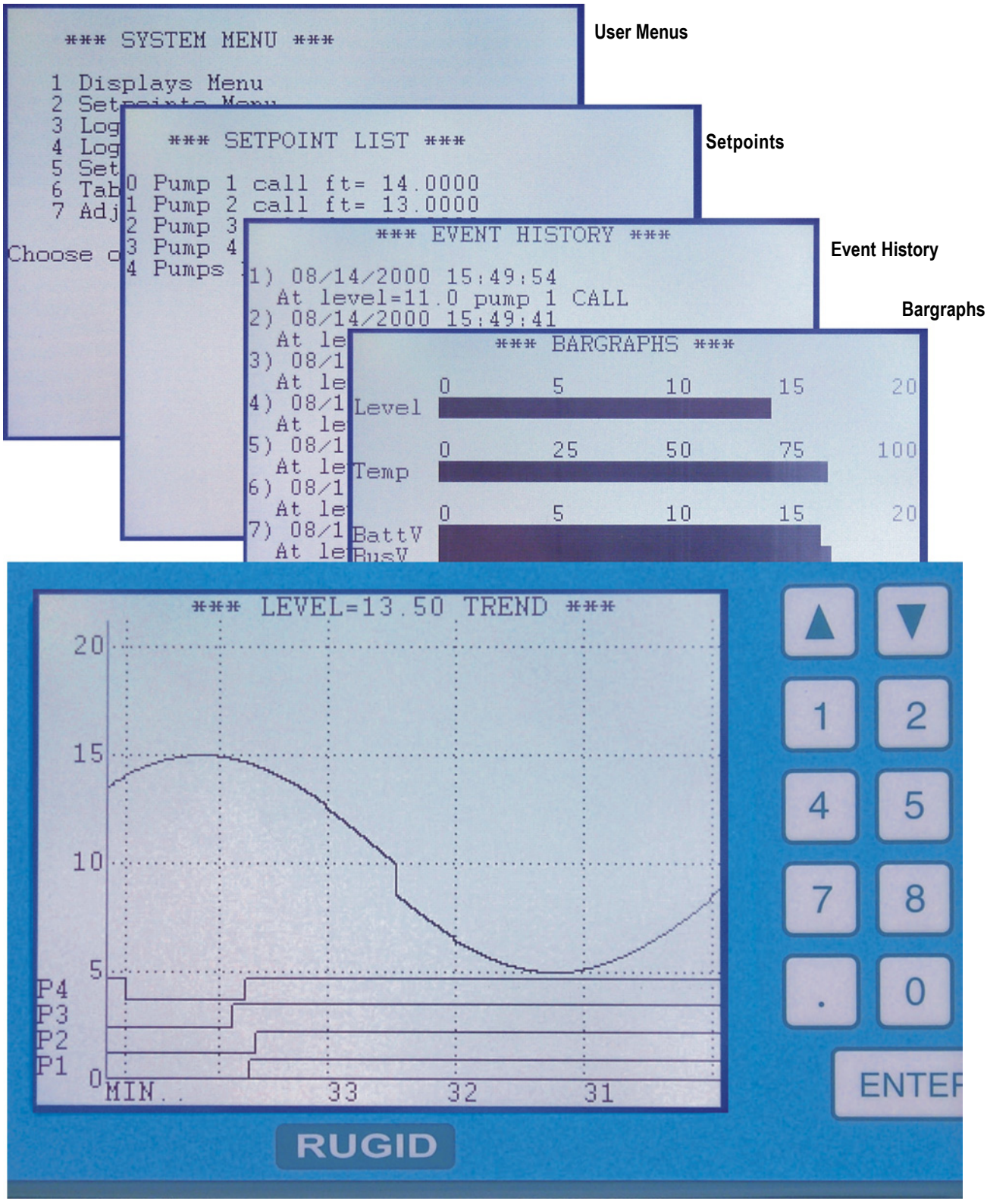
I/O is optically isolated in groups.

I/O is modular and can be supplied with any combination of digital I/O, analog I/O or modem.

LCD DISPLAY

Provides Convenient Operator Interface

Large backlit LCD displays provide operator with complete operational realtime information as well as past history, including event histories and trend plots. Simply hitting the ENTER key presents the next display in the list. The number of displays is limited only by flash storage...those shown here together use less than 3% of available flash memory.



User Menus

Setpoints

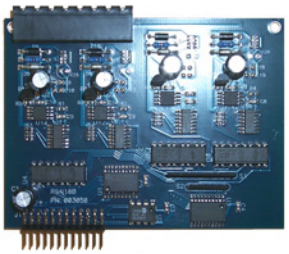
Event History

Bargraphs

TREND...Display shown actual size

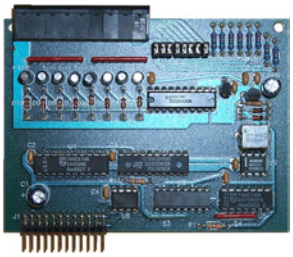
EXPANSION CARDS

Tailor Units to Your Needs



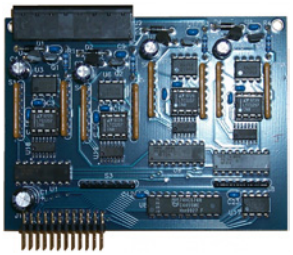
4 CHANNEL ANALOG INPUT - R9AI16/4

16 bit resolution, 4 channel analog input board.
Compatible with 4-20 ma. industry standard current loops.
Full channel to channel optical isolation enables insertion into existing current loops.
Factory calibration stored in onboard EEPROM.
Onboard protection against reverse voltage application, and overvoltage.



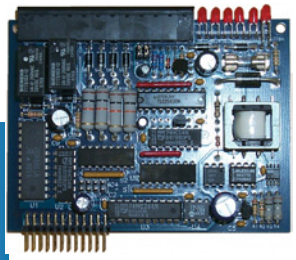
8 CHANNEL ANALOG INPUT - R9AI8

2500 V opto-isolation per channel.
Inputs can be 4-20 ma. or 0-5 VDC.
On board factory calibration stored in EEPROM.
On board field power supply allows readings down to zero volts, zero milliamps.



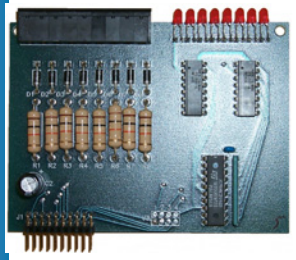
4 CHANNEL ANALOG OUTPUT - R9AO4

2500 V opto-isolation per channel.
12 bit resolution, 4-20 ma. standard.
On board factory calibration stored in EEPROM.
Complies with 50 VDC loops.
Reverse voltage protected.



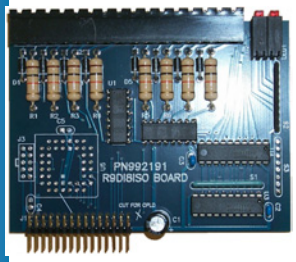
COMBO - R9COMBO

Replaces up to 4 other boards.
2-AI's, 4-DI's, 2-relay outputs, 24 VDC loop supply
All I/O optically isolated
AI's 12 bit resolution, 4-20 ma. or 0-5 V compatible.
DI's 24 VDC or 120 VAC compatible.
Relays 3 amp/120 VAC.
Loop supply 24 VDC/160 ma. regulated and isolated.



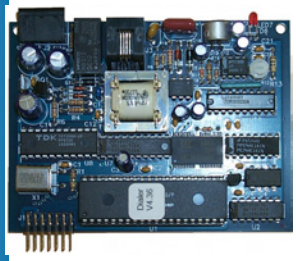
8 CHANNEL DIGITAL INPUT - R9DI8

2500 V opto-isolation from bus.
Inputs can be 120 VAC or 24 VDC.
Only 3 ma. required per channel.
Can be used as status, pulse duration, or pulse counter inputs.



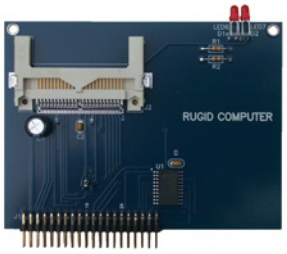
8 CHANNEL DIGITAL INPUT ISOLATED - R9DI8IS0

Full channel to channel 2500V isolation.
Inputs can be 120 VAC or 24 VDC.
Only 3 ma. required per channel.
Can be used as status, pulse duration, or pulse counter inputs.



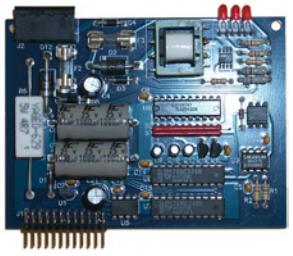
DIALER - R9DIAL

Flash memory storage of up to12 minutes of speech.
Uncompressed speech is clear and language independent.
Easy recording using built in microphone.
Phone interface supports autodialing/autoanswer.
Software provides for easy verbal report definition.
User can change setpoints from phone.
Radio keyer enables speech over radio system.



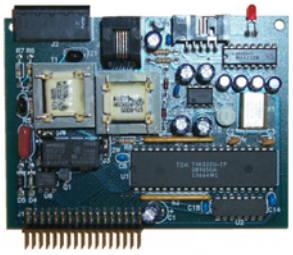
FLASH DISK - R9FLASH

Nonvolatile flash storage requires no batteries.
Small size (1.6 x 1.4 in.), rugged cards can be easily transported.
Card capacity of 2, 4, 10, 15 Mbytes can be matched to application.
Cards can be read by standard PC with standard PCMCIA carrier.
Time tagged floating point data and event logs are stored as ASCII files



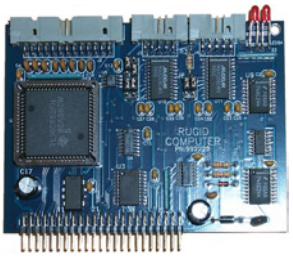
LOOP/CHARGER/DIAGNOSTIC - R9LOOP

Loop supply 24 VDC/160 ma. regulated and isolated.
Lead acid battery charger, 160 ma.
Onboard diagnostics for AC power fail, battery voltage/fail, temperature.
Fuses and diodes protect against reverse voltage application.
LED's show bus, loop and charge status.



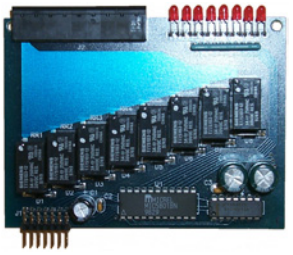
MODEM/RS232 - R9MDM

Bell standard tone use, Bell 103/212, 300/1200 baud.
Transformer isolation on RCV and TX.
Isolated radio key line.
Optically isolated ring detector.
Adjustable transmit amp.
Standard RS232 port.
Compatible with standard radios, radio modem units, and spread spectrum radios.



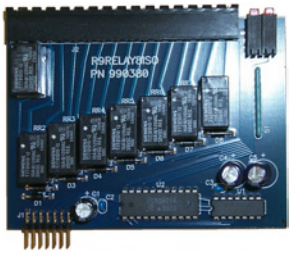
PRINTER/DUAL RS232 - R9PRINT

Provides 2 RS232 ports + one parallel printer port.
One RS232 port jumper selectable as RS485.
Other RS232 port jumper selectable as SDI-12.
All standard baud rates supported along with many non-standard rates.
Preprogrammed modules set baud rate, protocol, and other parameters.



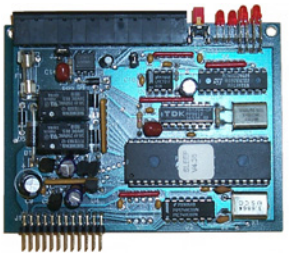
8 CHANNEL DIGITAL OUTPUT - R9DO8

4000 V contact to coil isolation.
Inputs can be 240VAC or 30 VDC.
3 amps per channel.
Can be used as status, control, alarm, or pulse duration outputs.



8 CHANNEL DIGITAL OUTPUT ISOLATED - R9DO8ISO

Full channel to channel isolation.
4000V contact to coil isolation.
Inputs can be 240VAC or 30 VDC.
10 amps per channel.
Can be used as status, control, alarm, or pulse duration outputs.

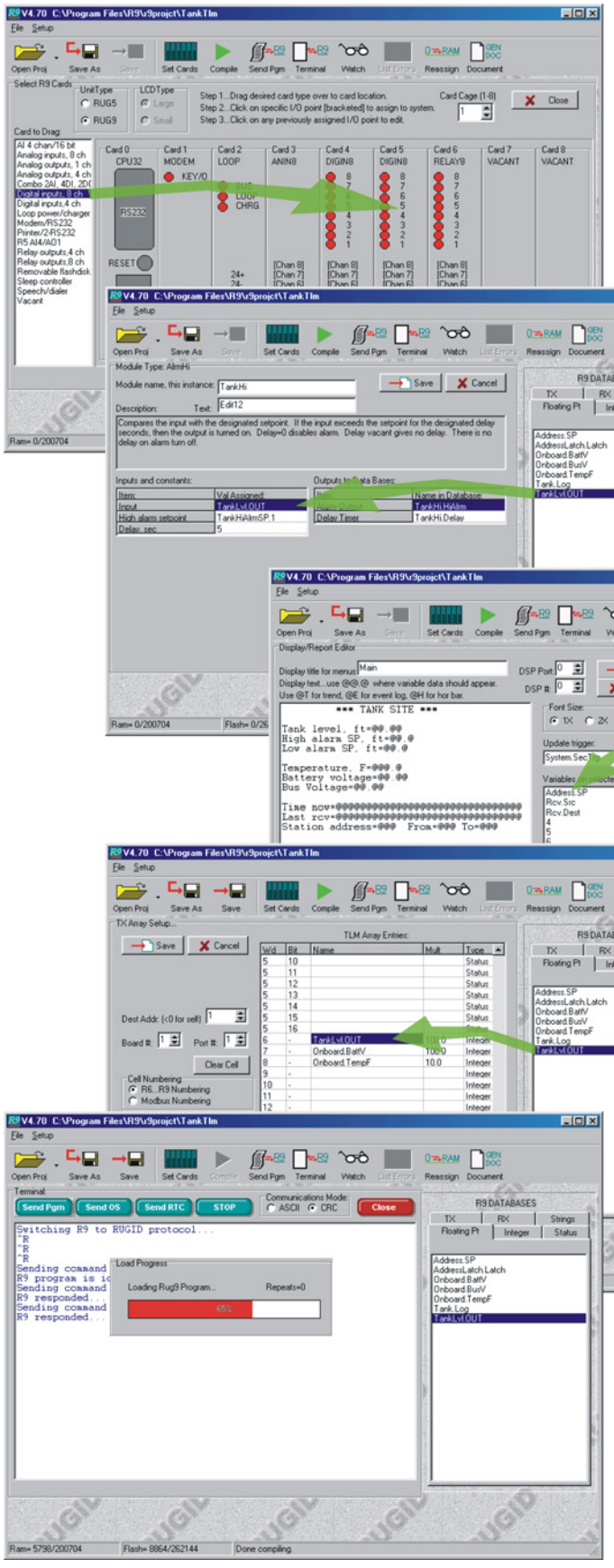


SLEEP CONTROLLER - R9SLEEP

Inputs can be dry contacts, logic, or analog.
Sleep timer up to 32 hours.
Sleep current 1 to 4 ma.
Can be awakened by button, contact, touchtone code, phone ringing, high wind speed, or analog value out of range.
Inputs can count tips and read encoder.

CONFIGURING RUG9...

No Programming!*



STEP 1:

Select cards and drag to slots in card cage, then name I/O points and set their properties/ranges, etc.

STEP 2:

Connect modules together by dragging from data base to module inputs. Names you give modules become new output signal names. Module outputs become new data base entries.

STEP 3:

Type in displays. Drag data base variables to be displayed into list box.

STEP 4:

Setup telemetry TX and RX formats.

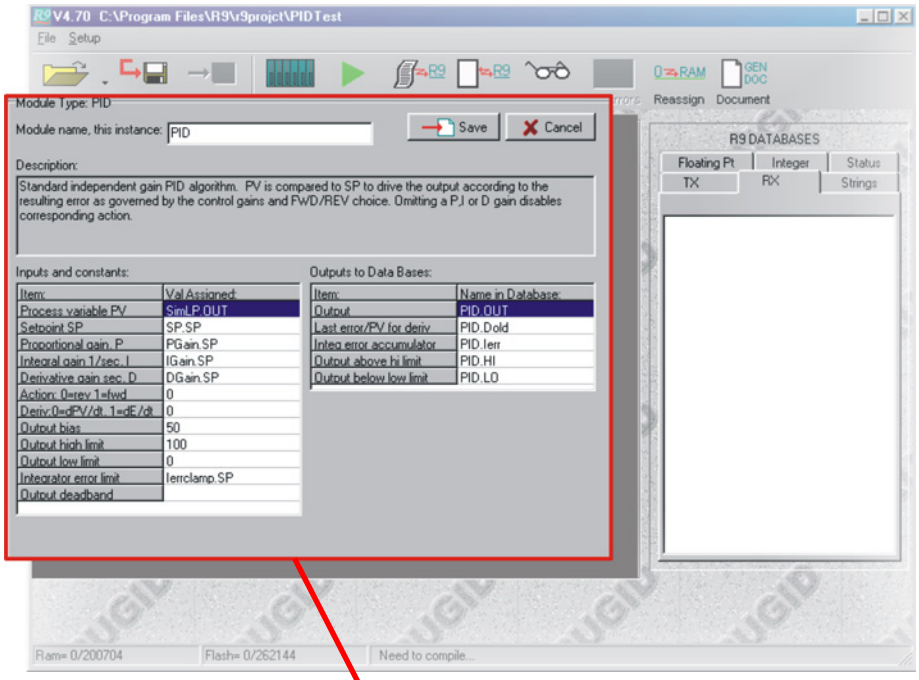
STEP 5:

Click on SendPgm button to transmit file to RUG9 and start program.

* The RUG9 supports ladder logic programming in addition to the precompiled software modules resident in its operating system.

RUG5/RUG9 PREPROGRAMMED MODULES

The software modules listed below are included in the RUG5/RUG9 operating system installed in each unit and included in the support software available at no charge from our web site, www.rugidcomputer.com. Updates can be installed into the RUG5/RUG9 in just a few minutes from your PC.



I/O MODULES
- Analog input 4-20 ma
- Analog input 0-5v
- Analog output 4-20 ma
- Bargraph display
- Diagnostics
- Digital input counter
- Digital output alarm
- Digital input AC
- Digital input DC
- Digital output
- Dump log to flash disk
- Get user value
- Message to display
- Pulse duration input
- Pulse duration output
- Pulse to flow
- Read calib. from EEPROM
- Setpoint
- Sleep
- Sleep presets
- Sleep read values
- Sleep setpoints
- System setup
- Write cal to EEPROM

MATH
- Arccosine
- Arcsine
- Arctangent
- Bits to Numeric
- Characterization table
- Cosine
- Cotangent
- Float to integer
- Flow CipolletiRect
- Flow container
- Flow convert/dropout
- Flow H flume
- Flow Manning
- Flow overshot gate
- Flow Palmer-Bowlus
- Flow Parshall
- Flow Q=A*(H+B)**C
- Flow trapez flume
- Flow Vnotch weir
- Gas flow AGA3
- Limit value
- Limit input value
- Low pass filter
- Mask integer
- Numeric to bits
- Numeric to string
- Polynomial Nth order
- Power
- Sine
- Square root
- Tangent
- Trigger to numeric
- Y=A*B
- Y=A-B
- Y=A/B
- Y=A*B*C*D*E*F*G*H
- Y=A*B+C*D+E*F+G*H
- Y=A+B*C/D-E
- Y=A+B*exp**(X+C)
- Y=A+B*rand(1)
- Y=A+B+C+D+E+F+G+H
- Y=A+B+C+D-E-F-G-H
- Y=abs(X)
- Y=Ln(X)
- Y=Log10(X)
- Y=MX+B
- Y=sqrt(X)
- Y=X^Z (power)

CONTROL
- Alarm high
- Alarm low
- Alarm mismatch
- AND gate
- Counter
- Counter stack
- Deadband
- Delay timer
- Exclusive OR
- Event logger
- Flip flop
- HOA
- HOA2
- Intrusion
- Latch float value
- Latch integer value
- Latch on bit change
- Latch string
- Lead lag sequencer
- Lookup switch
- OR gate
- OR gate latched
- PID
- Poke
- Poke many
- Pulse generator
- Pump down controller
- Pump up controller
- Pump up/down controller
- Rate of change
- Read realtime clock
- Read table row float
- Read table row integer
- Read table row string
- Sequencer timed #2
- Sequencer timed
- Sequencer up/down
- Sequencer out (expander)
- Set realtime clock
- String switch
- Toggle
- Trigger every X minutes
- Trigger every X seconds
- Trigger generator
- Trigger on bootup
- Trigger on change
- Trigger on change many
- Trigger on keystroke
- Trigger on key log
- Trigger on realtime clock
- Trigger on bit then clear
- Value equal
- Value test
- Value test/value out
- Write table row

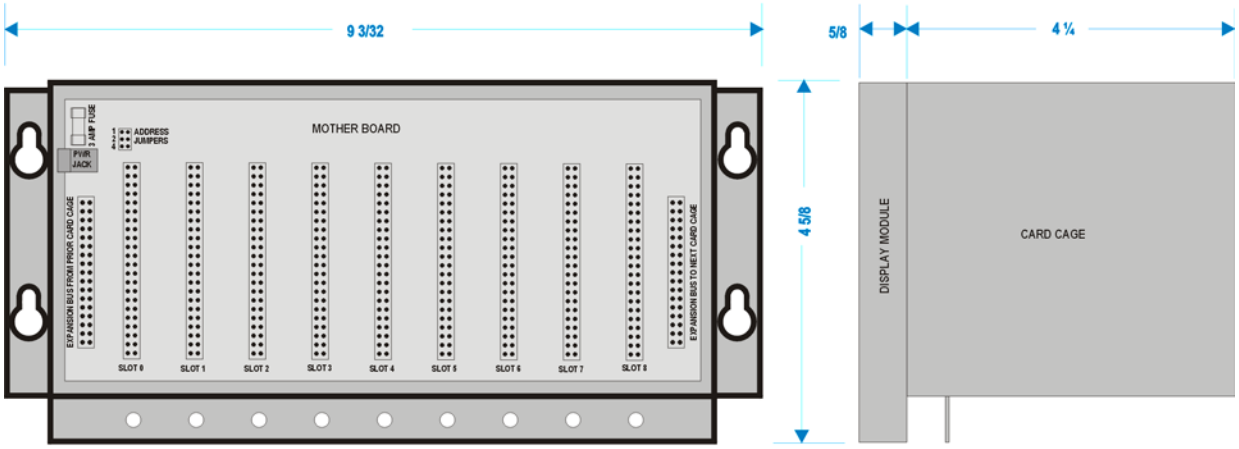
STATISTICS
- Average value
- Data logger
- Max value
- Min value
- Sliding average
- Sliding rate
- Totalize event
- Totalize flow
- Totalize time

COMMUNICATIONS
- Communications setup
- Dial modem
- Dump log to port
- Dump log to flash disk
- Forward port switch
- Get string from port
- Poll
- Poll Modbus
- Poll sequencer
- Printer setup/watch
- Quiescent controller
- Send string to port
- Sequenced poller
- Set display
- Speech dial/autoanswer
- Speech record/play/delete
- Speech dialing sequencer
- Trigger on modbus write
- Trigger on reception

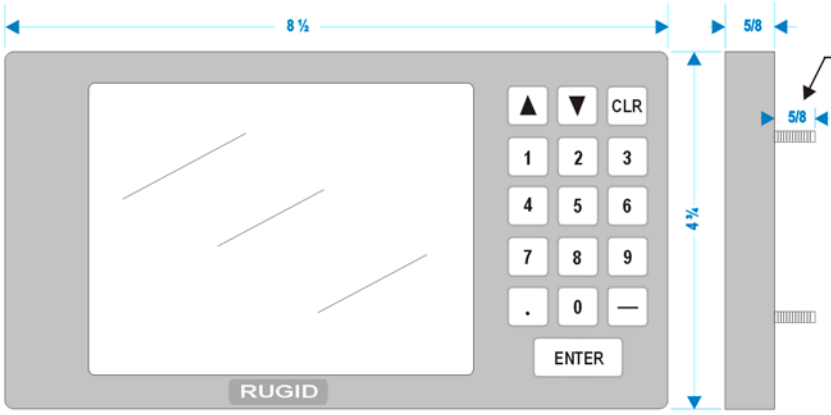
MAJOR BLOCKS
- Display definition
- Display trending
- Event logger
- Ladder logic
- Modbus master & slave
- R6/R9 CRC secure comm
- Speech report setup
- Table setup
- Watch window debugger

UNIT DIMENSIONS

RUG9 CARD CAGE

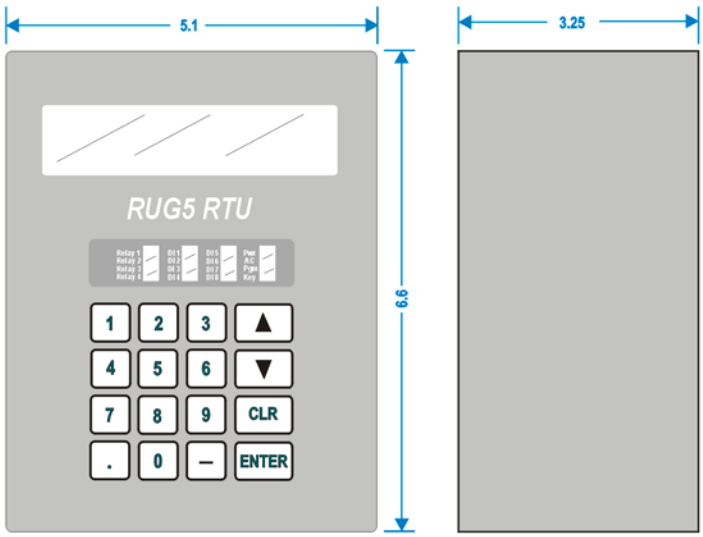


RUG9 DISPLAY

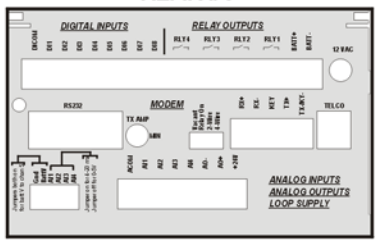


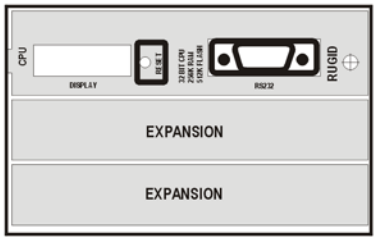
RUG9 display module can be hinged onto RUG9 card cage or mounted remotely up to 5 feet away. RUG9 display can also be connected to the RUG5 in lieu of the smaller RUG5 display.

RUG5



REAR I/O





FRONT I/O

RUG5/RUG9 SPECIFICATION

LOGIC FAMILY
All low power CMOS

MICROPROCESSOR
32-bit 68331, 16 Mhz, 16 bit data bus, 24 bit address bus

MEMORY
RAM-256 Kbytes battery backed low power static RAM
FLASH-512 Kbytes
Battery Backup-Lithium coin cell backs up RAM & realtime clock/calendar min 2 years

MEMORY CARTRIDGE
4 Mbyte to 10 Mbyte removable Sandisk Flash cartridge

I/O EXPANSION-RUG9
First card cage can have any I/O, up to 8 cards plus CPU. Up to 7 card cages attach with ribbon cables, can hold up to 64 ch per cage

I/O EXPANSION-RUG5
Rear-8DI, 4DO, 4AI, 1AO, Modem, Loop, Charger
Front-Any 2 RUG9 boards

DISPLAY-RUG9, RUG5 optional
20 line x 40 char (320 by 240 dot) backlit graphic LCD, 6 in diag. detachable from card cage
Text-All std ASCII chars plus special graphic chars
Trends-Up to 10 traces per page; pages incorp into user defined text pages, as many as will fit in flash. User defined scale grid
Bargraphs-Up to 20 hor bars/display page to show analog values

DISPLAY-RUG5
2 line by 16 character LCD

KEYBOARD
16 key sealed tactile membrane with interrupt scanning

REALTIME CLOCK/CALENDAR
Battery backed clock/calendar 0.005% crystal accuracy

SPEECH SYNTHESIZER
8 Khz sampling record & playback. Up to 256 messages in 12 minutes total storage

OPERATION SECURITY
Watchdog Timer-Hardware timer resets unit 0.5 sec. after interrupt fail. Cannot be disabled

AUTOBOOTING
Auto startup on power application

I/O SURGE PROTECTION
All I/O is optically isolated, meets IEEE surge protection requirements

ANALOG INPUTS-12 bit
8 ch per board, 12 bit res., successive approx, optically isolated, 4-20 ma. or 0-5 v. Factory calibrated

ANALOG INPUTS-16 bit
4 ch per board, 16 bit res., optically isolated 4-20 ma. Factory calibrated

ANALOG OUTPUTS
1/4 chan per board, 12 bit resolution, optically isolated

DIGITAL INPUTS
Status-8 chan/board, optically isolated, 120VAC or 24 VDC compatible
Pulse Counting-All DI channels in first card cage count 128 pps
Pulse Duration Detecting-All DI in first card cage can convert pulses to analog with 4 ms resolution

DIGITAL OUTPUTS
4/8 ch per board, 10/3 amp relays
Pulse Duration Outputs-Base relays can generate PWM or one shot signals with 4 ms res.

SERIAL PORTS
Up to 8 RS232/modem ports or 8 dual RS232/printer ports in base card cage

MODBUS PROTOCOL
Std RTU master or slave protocol on any port except programming port

MODEM
Bell 103/212 standard

RADIO INTERFACE
4-wire audio, adjustable gain, xformer isolated, isolated key line. Low tones mode for splinter chan

PHONE INTERFACE
2-wire audio adjustable gain, transformer isolated

AUTODIALING
On/off hook relay, touchtone generate

AUTOANSWERING
On/off hook relay and ring detector

TOUCHTONE DETECTION
Standard tones on speech board

COMMUNICATIONS
Background CRC gen/decode, variable length messages, user defined message lengths. Can combine status, int, float, and double precision int in any message

EAVESDROP MODE
Any RTU can accept data passing between any other stations

PEER TO PEER
Full RTU to RTU or RTU to master or master to RTU messaging

STORE AND FORWARD
Initiating station sets path through up to 3 intermediary stations

ADDRESS RANGE
1 to 255

PRINTER/RS232 PORT BOARD
Standard Centronics compatible parallel port, dual RS232 ports. Selectable RS485 port 1; SDI-12 port 2

FLASH CARTRIDGE INTERFACE
Board accepts 4 M to 16 Mbyte removable Compact Flash cartridge. Dumps logged data in ASCII

POWER INTERFACE
12 VAC/15 VDC +/-20%, 130 ma. to 2.5 amps max, resettable fuse.

LOOP SUPPLY
Isolated, regulated 24 VDC +/-5%, fused, 160 ma.

BATTERY CHARGER
160 ma., reverse protected, fused

I/O CONNECTIONS
All I/O uses removable rising cage screw headers in banks of up to 16 each, 14 ga wire

SOFTWARE
Storage-Operating system and all user config. and programming stored in nonvolatile flash memory. Flash loader stored in flash protected boot block
Security-Parameter voting and memory integrity test on boot up, CRC gen/detect on serial ports
Scanning-Built in software scans all I/O, ports, timers, realtime clock

PROGRAMMING
Modules-Applications use precompiled modules resident in flash memory where programmer interconnects modules and sets properties using supplied Win95/98/2000/NT program. No programming required for most applications

LADDER LOGIC
Ladder logic built in to the Win95/98/2000/NT configuration program to handle misc controls

VARIABLES
Supports 32 bit integer, floating point, boolean, strings, and arrays

ERROR MESSAGES
Configuration program handles all setup errors. Run time software is self protecting...no run time errors

ENCLOSURE
16 ga. steel, blue powder coat card cage with display/keyboard module

TEMPERATURE RANGE
-40 to +85 deg. C logic
-20 to +60 deg. C LCD display

DOCUMENTATION
300 page bound manual

WARRANTY
1 year std limited warranty

REPAIR
Nominal 24 hr turnaround

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