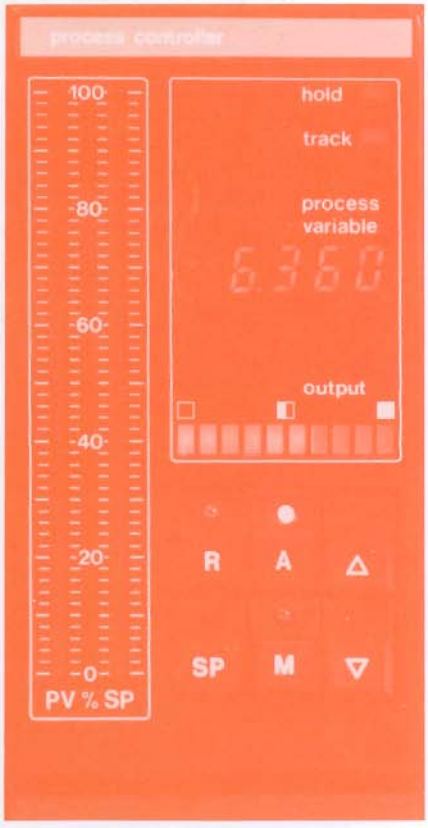
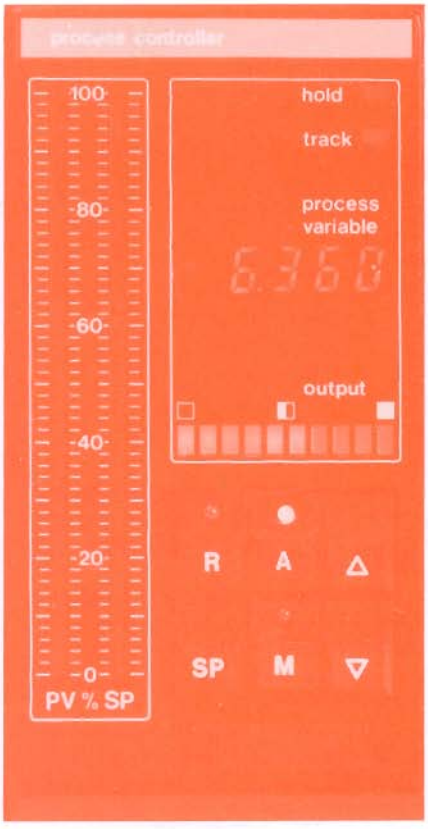
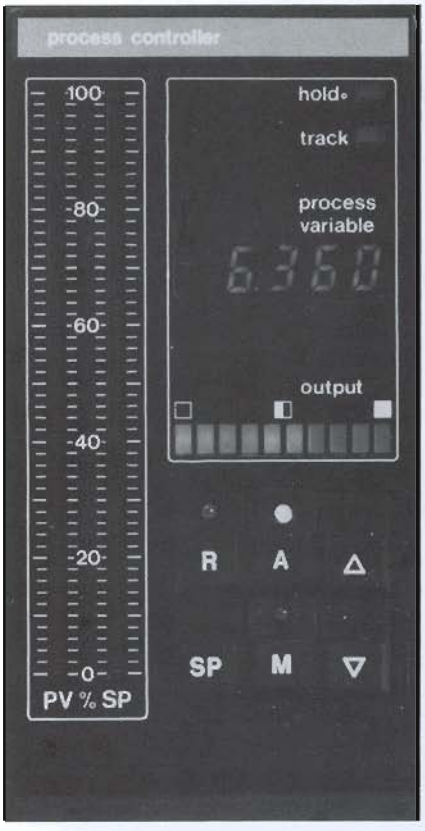
process controller

system 6000

6360







product specification

3-term and ratio controller: Features

- No options.
- All controllers are identical and interchangeable.
- Single loop integrity.
- Built-in diagnostic routines.
- PID, Ratio or ON/OFF control.
- Microprocessor technology and solid state displays.
- Remote monitoring and supervision via a simple serial link.
- Field proven unit with a two-year warranty.
- Fully compatible with the TCS range of advanced instrumentation.

Description

The 6360 single loop process controller combines the flexibility of modern microprocessor technology with the integrity associated with conventional analogue instruments.

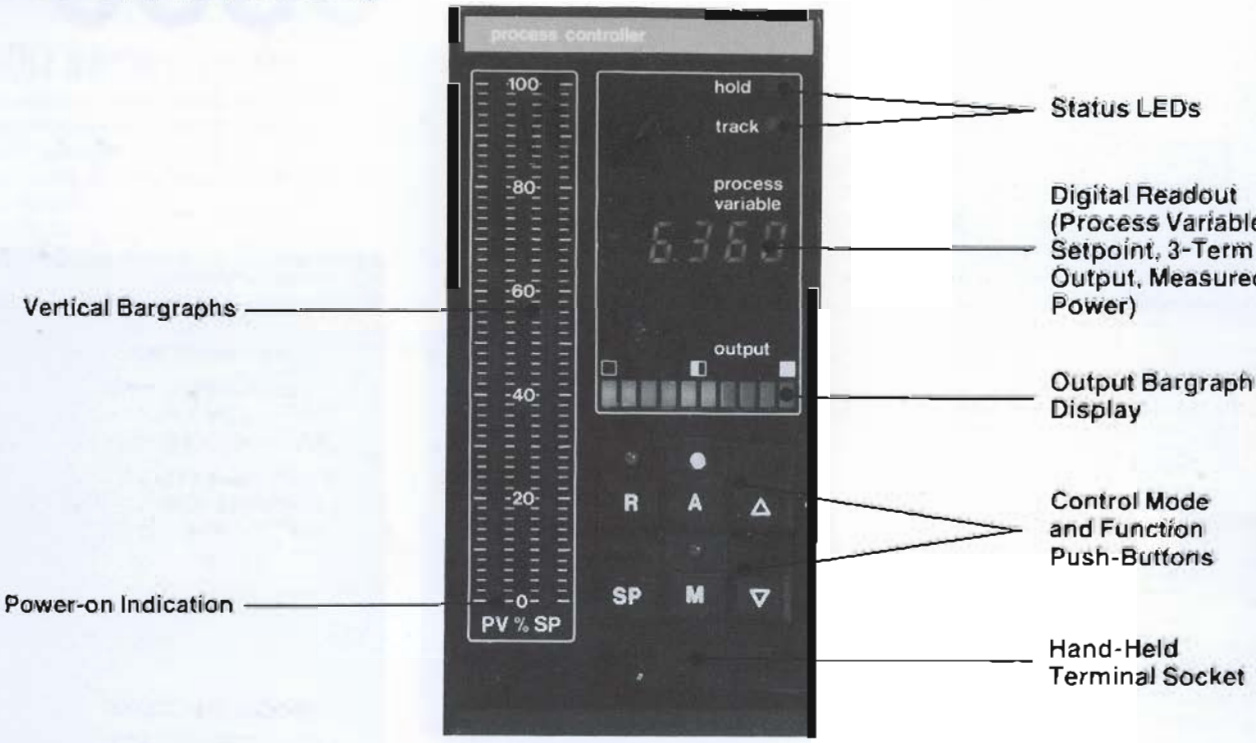
A microprocessor is incorporated in every 6360 enabling a user to characterise each device for any 3-term, ratio or ON/OFF control loop function using a simple plug-in hand-held terminal. As the loop characteristics are defined by easily changed parameters all 6360 controllers are identical and interchangeable regardless of application. One 6360 is a spare for all the others on a plant as its function is defined and changed by the technician via the hand-held terminal. Use of the terminal ensures security of the settings which are retained indefinitely when the device is powered and for at least five years if unpowered.

Functionally the controller operates as a conventional analogue unit providing facilities to raise/lower the setpoint, ratio or output, via front panel push-buttons and to change control mode to Manual, Automatic, Remote (for cascade connection) or Ratio. The 6360 will interface to 4-20mA signals from plant mounted equipment or 0-10V signals from the System 6000 range of signal conditioners and output drivers.

Each controller has a suite of input linearisation routines and TCS will provide custom linearisation at an additional cost. As well as providing a control output the 6360 generates 0-10V signals representing the linearised process variable and the setpoint or error deviation.

Supervision and monitoring of the 6360 is made particularly simple by the provision of a communications interface. This allows an intelligent device to monitor or update any of the control parameters of a network of 6360 controllers via an RS422 serial bus using a standard ANSI protocol. The use of a TCS 8245 Communications Buffer Unit enables RS232, TTL and fibre optic interfaces to be implemented.

The solid state technology offers high levels of reliability while the diagnostic procedures built into each instrument provide further output integrity.



Operator displays and controls

Operator displays

Vertical Bargraph
Two 101 segment bargraphs displaying process variable and set point.

Digital Readout
(for process variable, setpoint, 3-term output and measured power indication) 4-digit, orange LED display with sign and decimal point.

Alarm Indication
High or low alarms indicated by flashing the process variable bargraphs.

Power-on Indication
Lowest segment of both bargraphs illuminated.

3-Term Output or Measured Power Display
Horizontal yellow LED bargraph with 10 segments to indicate 0-100% output

Status Indicators
2 yellow rectangular LEDs to indicate TRACK and HOLD status

Operator controls

Control Mode Selection
3 illuminated push-buttons:
Manual (M) with integral yellow LED.
Local Auto (A) with integral green LED.
Remote Auto or Ratio (R) with integral green LED.

Function Selection
2 non-illuminated push-buttons:
Raise (▲) increments the output when Manual (M) is pressed, or increments the setpoint when (SP) is pressed.
Lower (▼) decrements the output when Manual (M) is pressed, or decrements the setpoint when (SP) is pressed.

Display Selection
1 non-illuminated push-button (SP) causes the digital readout to display the current setpoint while pressed.

NOTE: Pressing the Manual, Auto or Remote buttons causes the digital readout to display the current output level or the measured power. Pressing the Raise or Lower buttons alone causes the alarm levels to be displayed on the bargraphs.

Applications

Gas pressure control
Extruder control
Boiler control
Brewing vessel control
Environmental chambers
Turbine test beds
Ethylene oxide plant
Hydrofluoric acid plant
Glass manufacture
Paper production
Cement production
Blast furnaces
Reheat furnaces
Adhesive coating line control
Paint oven control
Oil production platforms
Viscose yarn production
Glycerine manufacture

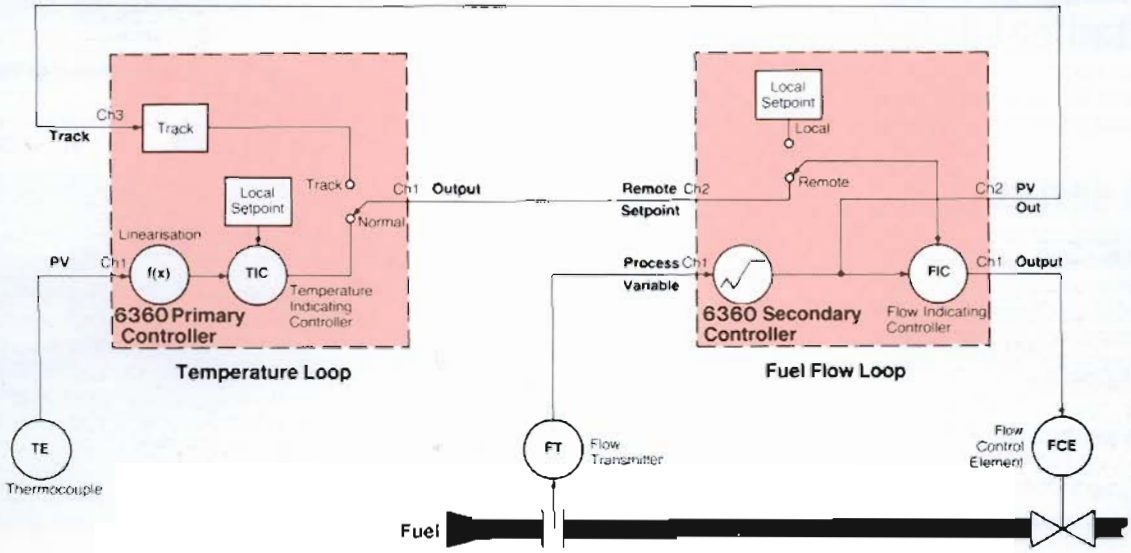
The powerful combination of sophistication with flexibility means that the 6360 controller has found ready applications in all of the above processes and industries.

All System 6000 instruments use standard voltage and current levels for their analogue and digital interfaces This means that multiple 6360 controllers can be interconnected to form complex loop configurations.

Comprehensive system interlocks are then made which result in all control mode selections being both bumpless and procedureless. Typical complex loops of this type are the Cascade and Ratio configurations illustrated below.

Cascade control

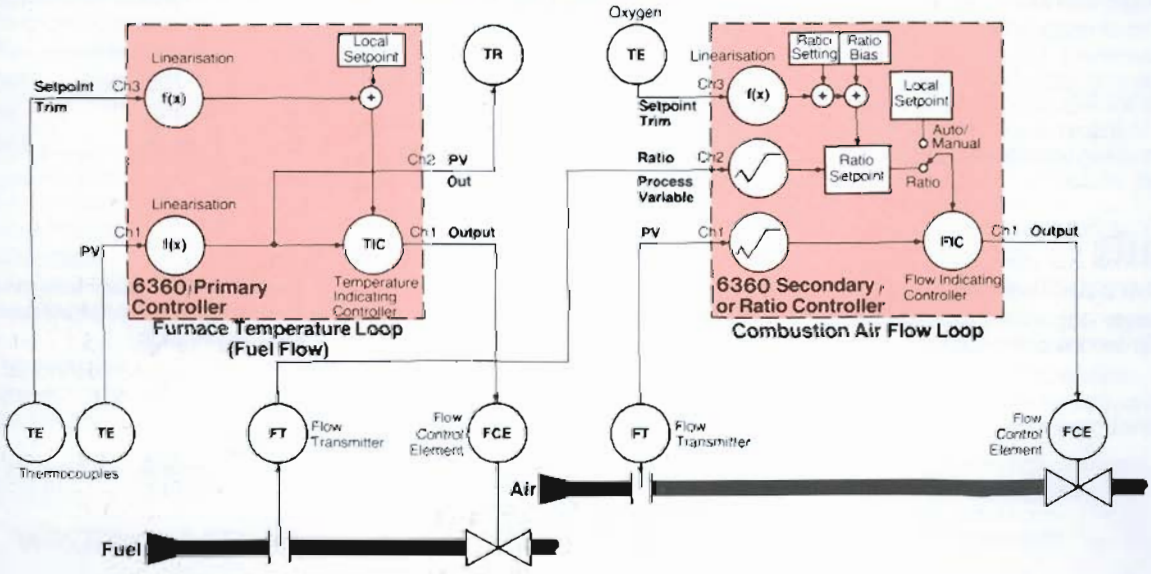
The example shows a process temperature being controlled through a secondary fuel flow loop using two 6360 controllers. To effect bumpless and procedureless switching between Remote, Auto and Manual on the secondary controller its process variable is retransmitted to the primary controller. This allows the output of the primary controller to track the process variable of the secondary controller whenever it is in Manual. The local setpoint of the secondary controller will track the remote setpoint value as long as it is in Remote. In addition an option switch allows the local setpoint of each controller to track its own process variable while it is in Manual.



Ratio control

The fuel-air ratio control system, illustrated, demonstrates several features of the 6360. The furnace temperature controller regulates the fuel flow and makes the linearised process variable available for recording. The controller can also use an external variable to trim the temperature setpoint.

The fuel flow is measured and linearised within the combustion air controller where the ratio and bias functions are executed to generate the correct setpoint to maintain the desired relationship between fuel and air flows. The combustion air controller also linearises an input from an oxygen monitor and uses this to trim the ratio setting to ensure efficient combustion.



Communications

Every System 6000 microprocessor based instrument is fitted with an RS232 port and an RS422 port for serial data communications. The RS232 port is available via a front-panel socket and is used for the 8260 Hand-held programming terminal. The RS422 port is available on the module rear connector pins and is bussed onto the supervisory data link common to all modules. All parameters that can be monitored via the 8260 terminal can also be accessed and updated via the supervisory data link.

Hand-held terminal link

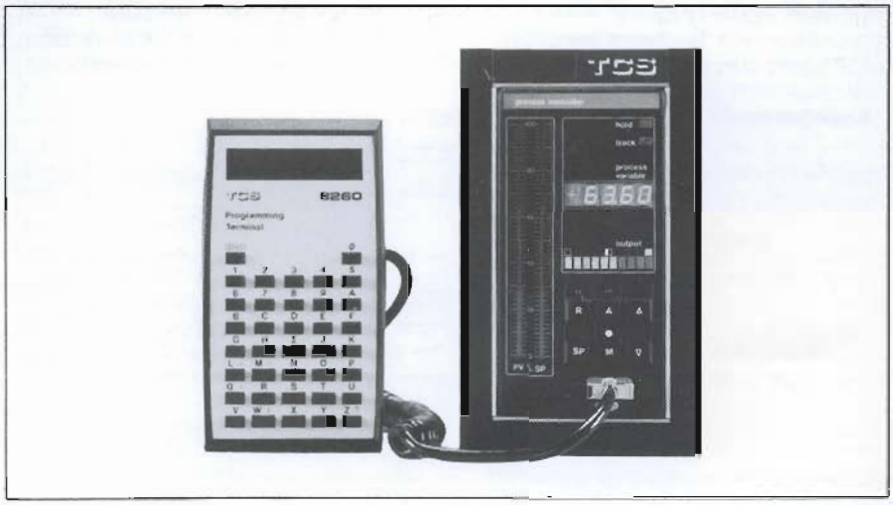
Each System 6000 instrument can be set up using a plug-in 8260 Hand-held terminal. Every parameter is accessed by means of a simple 2 character command mnemonic and all data is entered directly in engineering units. This technique ensures the accuracy and security of parameter settings.

Specification

Transmission Standard
2-wire RS232/V24 (± 12V).

Data Rate
300 baud.

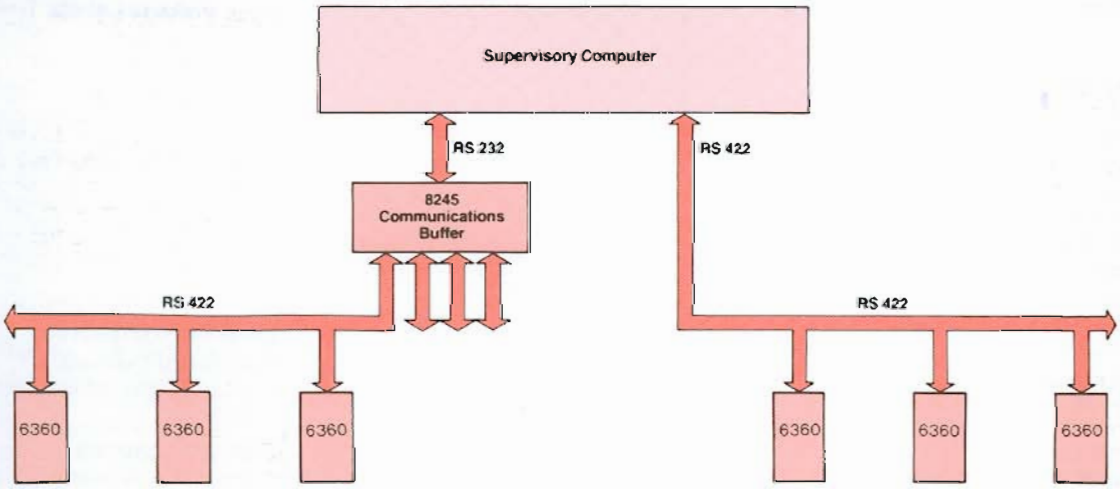
Character Length
10 bits made up of:
1 start + 7 data + 1 parity (even) + 1 stop.



The photograph shows an 8260 terminal plugged into the front-panel of a 6360 controller. A full list of the available command parameters is given in the 6360 Facts Card.

Multi-drop supervisory link

Every System 6000 instrument contains an RS422 communications port which enables it to send and receive command parameters over a simple four-wire link connected to other intelligent devices. The use of RS422 and the transmission of information in ASCII or Binary data format makes it particularly easy to communicate with the 6360 controller. To hook the 6360 into a distributed control system requires no modification to the instrument and no further expenditure on options. The four-wire link is simply connected up so that the 6360 becomes part of the distributed control system. The illustration shows how an array of 6360's can be directly connected to a supervisory computer which has an RS422 serial port. If the computer only has an RS232 serial port then an 8245 Communications Buffer Unit can be used to carry out the required RS232 to RS422 conversion as shown.



Specification

Transmission Standard
4-wire RS422 (0-5V).

Line Impedance
120-240Ω twisted pair.

Line Length
4000 ft max. (at 9600 baud)

Number of Units/Line
16.

Data Rate
Selectable from 110, 300, 600, 1200, 2400, 3600, 4800, or 9600 baud.

Character Length (ASCII/Binary)
10/11 bits – 300 to 9600 baud.
11/12 bits – 110 baud (2 stop).

Protocol

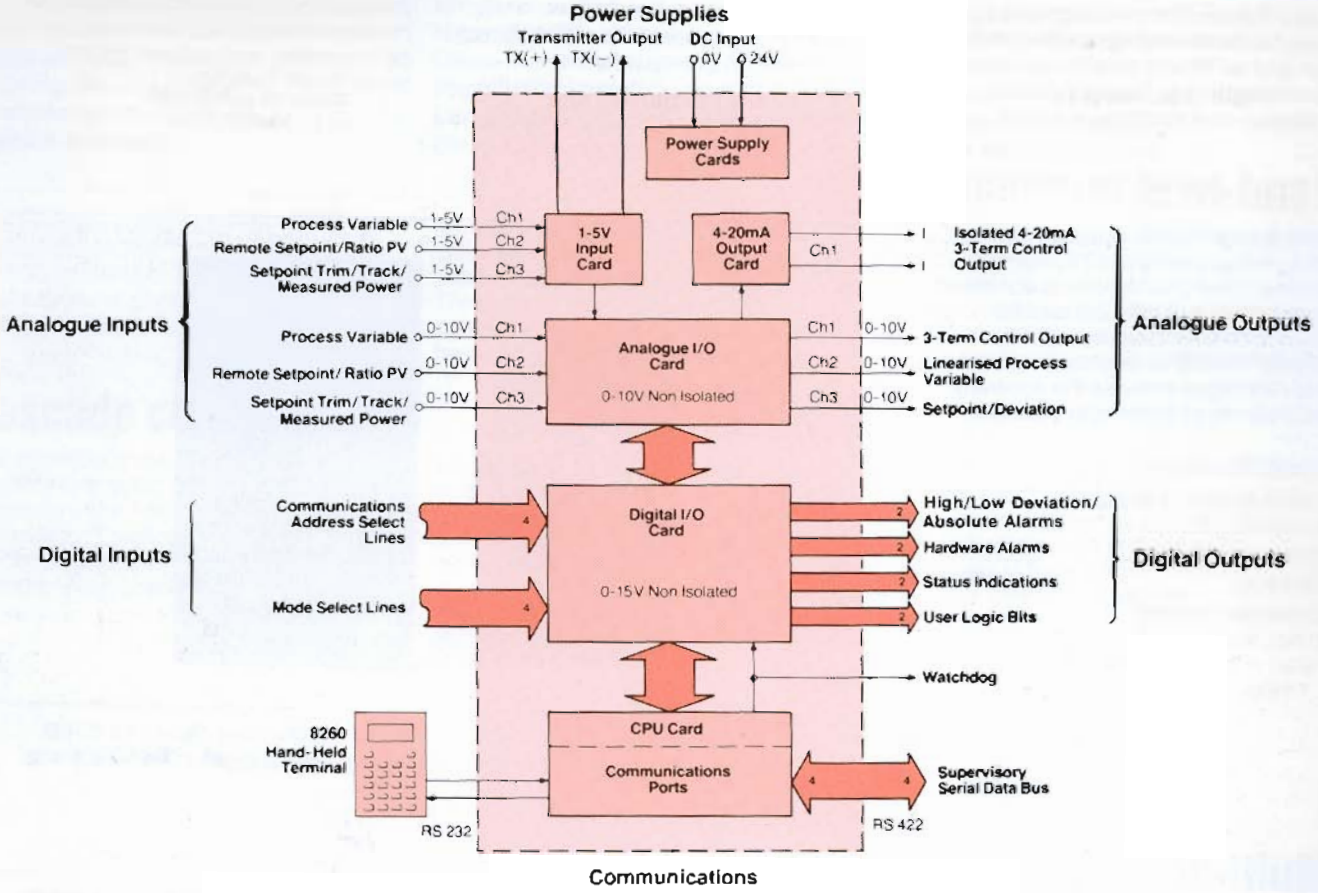
All microprocessor based instruments in the System 6000 range employ a standard ANSI protocol known as BI-SYNCH. The exact form of BI-SYNCH implemented within System 6000 corresponds with the American National Standard specification:

ANSI – X3.28 – 2.5 – A4 Revision 1976

TCS have implemented both an ASCII and Binary version of this protocol within each instrument.

The ASCII mode is simplest to use as all data is transmitted in ASCII characters. The Binary mode offers a 4 to 1 increase in transmission speed by compressing the data into a binary format, and also supports additional features like Multi-Parameter and Enquiry Polling.

Input/Output signals



Analogue inputs

Number of Channels
3 direct non-isolated inputs or 3 conditioned non-isolated inputs.

Channel Functions
Channel 1 = Process Variable input.
Channel 2 = Remote Setpoint/Ratio Process Variable input.
Channel 3 = Setpoint or Ratio Trim/ Track/Measured Power input.

Input Signal Levels
Direct inputs are 0-10V range, conditioned inputs are 1-5V or 4-20mA range with external sense resistors.

Resolution
12 bit binary ADC (.025%) hardware applied to inputs.
15 bit binary representation obtained after digital input filtering and signal averaging giving resolution of 1 digit in ± 9999.

Accuracy
± 1 LSB max. over 0 to 50°C range for hardware
± 1 digit of reading for 0-4000 range.
± 2 digits of reading for 0-8000 range.
± 3 digits of reading for 0-9999 range. after input filtering.

Sampling Rate
ADC samples 1 channel every 12ms, i.e. any one channel is sampled once every 36ms.

Input Impedance
1MΩ pull-down to −5V on channel 1.
1MΩ pull-down to 0V on channels 2 and 3.

Input Signal Processing
Linear (normal or inverse).
Normalised square root.
Type J, K, T, S, R, E, B thermocouples.
Platinum resistance thermometers.
User specified linearisation functions.

Analogue outputs

Number of Channels
3 direct non-isolated outputs plus 1 isolated output.

Channel Functions
Channel 1 = 3-Term control output
Channel 2 = Process Variable output.
Channel 3 = Setpoint output or amplified deviation (error).

Output Signal Levels
Direct outputs are 0-10V range.
Isolated output is 4-20mA (channel 1 only).

Output Circuit Type
Medium-term analogue sample-and-hold circuits preceded by DAC

Output Resolution
12 bit binary (.025%) giving minimum analogue voltage steps of 2.5mV

0-10V Output Accuracy
± 1 LSB max. over 0 to 50°C range

Isolated Output Accuracy
± 0.5% of full scale.

Sample and Hold
DAC updates 1 channel every 12ms, i.e. any one channel is refreshed once every 36ms.

Output Drift Rate Under Watchdog Failure Conditions
½mV/sec maximum (equivalent to 1% of full scale in 3 minutes)

Output Drive Capability
± 5mA for direct voltage outputs

Isolation Voltage
± 50V minimum with respect to system ground.

Digital inputs

Number of Inputs
8 external non-isolated inputs.

Input Functions
4 communications unit address select lines.
4 mode select lines.

Input Voltage Levels
15V = logic one.
0V = logic zero.

Input Impedance
100kΩ pull-down to 0V (gives 150μA logic one current).

Digital outputs

Number of Outputs
8 external non-isolated outputs plus Watchdog.

Output Functions
2 deviation or absolute alarms.
2 hardware alarms.
2 status indications.
2 user logic bits.

Output Voltage Levels
15V = logic one.
0V = logic zero.

Output Drive Capability
2k2 open-collector pull-up to +15V supply, maximum logic zero sink current = 16mA.

3-term control characteristics

Algorithm Sampling Period
36ms to 1.56s dependent upon integral and derivative times.

Setpoint
range – low, high– 9999 to + 9999.
limits – low, high– 9999 to + 9999.

Setpoint Trim
range – low, high– 9999 to + 9999 in engineering units.

Alarm Limits (Absolute)
Low, high –9999 to +9999 with hysterysis of 1/2% of setpoint span.

Alarm Limits (on deviation)
Low, high 0 to 9999 with hysterisis of ½% of setpoint span.

Input Filter Range (all inputs)
0 to 99.99 sec (first order).

Control Output
range – 0 to 99.99% = 0-10V or 4-20mA (Ch1).
limits – high, low – 0 to 99 99%
polarity – inverse output mode switch selectable.
raise/lower rate in manual – 0 to 99.99% in 10 sec with accelerating action.

Proportional Band Range
0 to 999.9%.

Integral Time Constant Range
0.04 to 99.99 sec or 0.01 to 99.99 min.
0 = off.

Derivative Time Constant Range
0.04 to 99.99 sec or 0.01 to 99.99 min.
0 = off.

Power supplies

Input Voltage
(May be unsmoothed, full-wave rectified AC).
20–30V DC recommended operating range.
19–35V DC absolute maximum input limits.

Input Current
600mA without hand-held terminal.
700mA with hand-held terminal.

Input Fuse Rating
2A.

Power Failure Detect Threshold
When input voltage falls below 16.5 ± 0.5V.

Remote Transmitter Supply
26V ± 1.5V at 4mA output
30V ± 0.5V at 20mA output.
± 50V minimum isolation with respect to system ground.

Memory Standby Battery
3.5V Lithium type.
500mAh rating.
8-10 year shelf life.
5 year life minimum on continuous standby.

Mechanical details

All System 6000 microprocessor based instruments are supplied in 72mm wide metal housings fitted with front-panel fascias and catch handles for module retention. These may be used with a wide variety of rack and panel mounting hardware as illustrated in the examples below.

7000 series racks

Up to six 6360 controllers may be fitted into a 7000 series 19 inch rack as shown. Interconnections between instruments are made by wire wrapping while external connections may be brought out to 2 rows of 64 way screw terminal blocks fitted to the hinge down rear door. The 7000 series rack is also available with a panel mounting option, and a 10 inch half rack version for mounting up to three 6360s can also be supplied.

7900 powered sleeves

The 7900 powered sleeve allows a 6360 to be mounted with a mains power unit. This is incorporated in the associated 7360 Rear Termination Assembly which is also fitted with alarm relays and gives access to all module connections via screw terminals. The 7900 assembly is available in single, 3 way, or 6 way versions for mounting in panels from 1.5mm to 6.5mm thick. A 6 way 19 inch rack mounting version can also be supplied.

Overall dimensions in mm of housings illustrated:

	7000 rack	7900 sleeve
width	482	105
height:	177	177
depth:	380	423

Panel cut-out dimensions in mm:

	7000 rack	7900 sleeve
width:	448.2	88.2
height:	166.3	166.3

Details

For further details refer to:
6360 Single loop microprocessor based controller technical manual.
6360 Facts Card.
7360 Process Controller rear termination assembly
7900 Single or multi-way sleeve assembly for microprocessor based instrumentation.

TCS
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