11. RECORDER SPECIFICATIONS

MEASUREMENTS

Number of Inputs: Up to 20 or 30 points.

Input Types, Range, Accuracy and Resolution:

Input Type	Range	Measurement (Digital display & printout)		Recording (Analog trend)	
		Accuracy	Resolution	Accuracy	Resolution
DC V	20 mV	± (0.05% of rdg + 5 digits)	1μV	±0.1% of span (not including measurement accuracy)	± 0.04% of span
	60 mV	± (0.05% of rdg + 2 digits)	10μV		
	200 mV	± (0.05% of rdg + 2 digits)	10μV		
	2 V	± (0.05% of rdg + 2 digits)	100μV		
	6 V	± (0.05% of rdg + 2 digits)	1mV		
	20 V	± (0.05% of rdg + 2 digits)	1mV		
	50 V	± (0.05% of rdg + 2 digits)	10mV		
TC	R *1 S *1	± (0.05% of rdg + 1°C) R, S: 0 to 100°C ±3.7°C 100 to 300°C ±1.5°C	0.1°C		
	B *1	B: 400 to 600°C ± 2°C			
	K *1	± (0.05% of rdg + 0.7°C) −200 to −100°C ± (0.05% of rdg + 1°C)	0.1°C		
	E *1 J *1 T *1	± (0.05% of rdg + 0.5°C) J, L: −200 to −100°C ± (0.05% of rdg + 0.7°C)			
	L *2 U *2				
	N *3	± (0.1% of rdg + 0.7°C)	0.1°C		
	W *4	± (0.1% of rdg + 1°C)			
	KP vs Au7Fe *5	± (0.05% of rdg + 0.7K)	0.1K		
RTD	Pt100 (1mA, 2mA) *6 JPt100 (1mA, 2mA) *6	± (0.05% of rdg + 0.3°C)	0.1°C		
	Pt50 (2mA) *7	± (0.05% of rdg + 0.3°C)			
	Ni 100 (1mA) *8 Ni 120 (1 mA) *8	± (0.05% of rdg + 0.3°C)	0.1°C		
	J263*B *9	± (0.05% of rdg + 0.3K)	0.1K		
	Cu10Ω GE, L&N, WEED, BAILEY	± (0.2% of rdg + 0.7°C)	0.1°C		
	High-sensitivity model Pt100 (1 mA) Pt100 (2 mA) JPt100 (1 mA) JPt100 (2 mA)	± (0.05% of rdg + 0.3°C)	0.01°C		
Contact Status	Input signal: contact status or DCV				

*1 R, S, B, K, E, J, T:
ANSI, IEC 584,
DIN IEC 584,
JIS C 1602 - 1981

*2 L : Fe-CuNi, DIN 43710
U : Cu-CuNi, DIN 43710

*3 N : Nicrosil-Nisil
IEC 584, DIN IEC 584

*4 W : W-5%Re-W-26%Re
Hoskins Mfg Co

*5 KP vs Au7Fe:
NBS Vol.76A

*6 Pt100 : JIS C1604-1989
JIS C1606-1989
IEC751,
DIN IEC751
JPt100 : JIS 1604-1989
JIS 1606-1989

*7 Pt50 : JIS C1604-1981
JIS C1606-1984

*8 Ni100: SAMA/DIN 43760
Ni120: McGraw Edison

*9 J263*B (Pt-Co):
YOKOGAWA

At 23 ± 2°C and 55 ± 10% R.H.

* Any of DC V, TC, RTD, and DI inputs can be selected for each input point.

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Reference Junction Compensation Error: ±1°C (R, S, B, W), ±0.5°C (K, J, E, T, N, L, U, KP vs Au7Fe).

Scan Cycle Time: 1 to 60s selectable (1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60s).

Scanning Rate: 60ms / channel.

A-D Integration Time: 20ms (50Hz), 16.7 ms (60Hz), and 100ms (50 / 60Hz) are selectable via an internal switch.

Input Impedance: More than 10MΩ on 2V or lower ranges and TC, approx. 1MΩ on 6V or higher ranges.

Input Bias Current: Less than 10nA.

TC Burnout Protection: 2kΩ or less (normal), 100kΩ or more (open), current approx. 6μA, detection pulse width approx. 2ms (ON or OFF selectable for each channel).

Temperature Spread on Terminals: Within 0.3°C among input terminals when temperature is balanced.

Allowable Source Resistance: Less than 1kΩ (DC V & TC).

Temperature Coefficient:
Zero drift ... 0.01% of range / °C,
Full Span ... 0.01% of range / °C.

Maximum Allowable Input Voltage: 60V DC. 50V DC for / ES.

Maximum Common Mode Voltage between terminal and case: 250V AC rms.
30V AC rms (for 3760 /ES Model)

Maximum differential noise between channels: 150V AC rms (50 / 60Hz).

Common Mode Rejection: More than 120dB (50 or 60Hz ±0.1%).

Normal Mode Rejection: More than 40dB (50 or 60 Hz ±0.1%).

PRINTOUT

Printing Technique: Raster scan using a wire-dot printer and a 10-color ribbon.

Effective Recording Span: 250mm (analog data).

Chart: Z-fold chart (342.5mm × 30m) with calibrated width of 250mm.

Recording Colors: Analog data (TREND mode) ... 10 colors (purple, red, green, blue, brown, black, navy blue, yellowish green, purplish red, orange), color can be specified for every channel, digital data (TREND mode) ... channel number, measured data, date & time, chart speed (black), alarm (ON mark ; red, OFF mark ; blue), LOG & LIST modes ... all data (purple).

Recording Accuracy: Measurement accuracy +(±0.1% of effective recording span).

Printout Format: Analog trend / analog trend + digital / logging.
The following recording is available in the trend mode, zone recording ... recording width and recording position (0 and 100% positions) settable in 1mm steps, partially expanded-scale printout ... can be specified for every point (one break point).
Recording can also be turned ON / OFF in every channel for the following items (panel setting), analog recording, measured value printing (1 to 4 rows), interpolation and moving average recording.
Recording common to all points for the following items (panel setting) can be turned ON / OFF ; alarm printing, scale value printing, scale value tick, and vertical or horizontal printing selectable in the logging mode.

Chart Speeds: 1 to 1,500mm / h.

Change of Chart Speed: Chart speed or logging interval is changed by remote control signals (optional) or alarm occurrence.

Print Cycle Time (Interval):
Analog recording interval in the trend mode:
FIX mode ... recording for interval is same as measuring interval (data is recorded every two scans in 1s scanning).
AUTO mode ... recording interval is determined in accordance with the chart speed.
Digital recording interval in the trend mode:
MULTIPLE mode ... selectable for each channel from any of three values (1min to 24h).
SINGLE mode ... chart speed and the number of recording lines automatically determine digital interval.
Interval in the logging mode :
MULTIPLE mode ... chosen and recorded from one of three types of interval for every channel (1min to 24h).
SINGLE mode ... recorded at a determined interval.

Chart Drive: Pulse motor drive.

Chart Speed Accuracy: ±0.1% (for recordings longer than 1m).

Start Time: Programmable for measurement (scan) and printing start time or T LOG interval.

Printout Mode:

1. NORMAL:
   Printing starts when START / STOP switch turned ON and stops when switch is turned OFF.
2. PRINT ON ALARM (Either one of the following is settable):
   TRIGGER mode ... Printing starts at set alarm ON*1, and stops at START / STOP switch OFF (set on shipment at the factory).
   LEVEL mode ... Printing starts at set alarm ON*1, and stops at alarm OFF.
3. CHART SP / INTVL CHANGE ON ALARM:
   Chart speed / interval changes at set alarm ON*1, and restored at alarm OFF.

*1 : All of the OR alarms or the set alarm.

Engineering Unit Printout: Engineering unit (up to 6 alphanumerics) can be defined and printed out.

Tag Number Printout: Tag number can be printed out in place of channel number (up to 7 alphanumerics).

Alarm Printout: Channel number, alarm type, and the time of alarm ON / OFF are printed.

Scale Markings Printout: Scale values (0 / 100%, 0 / 50 / 100%, or 20% steps) can be printed out.

Program List Printout: Contents of entire setting memory can be listed on the chart.

Manual Printout: Time and measured data for all channels can be printed out for a single line by a push of MANUAL PRINT key, input signal or alarm.

Message Printing: Printing contents ... message (max. 16 characters) and day and time, external contact ... 5 types of messages can be printed out, input signal ... volt-free contact, signal duration of 2 or more, alarm ... 5 types of message (max. 16 characters) can be printed out. Time interval message (max. 16 characters), panel key message (max. 32 characters) is printed out.

Header Printing: Header information of 80 characters × 5 lines is printed by depressing panel key.

Relation of Chart Speed and Printing

Chart Speed (mm / h)	CH No. / TAG No.	Date, Hr., Chart-Speed, Measured value	Alarm, Scale Value, Message (title)
1 to 9	○	×	○
10 to 500	○	○	○
501 to 1200	×	×	×

Printing Intervals of Digital Data (Analog recording & digital printout)

Chart Speed (mm / h)	Printing Intervals of Digital Data			
	1 line	2 lines	3 lines	4 lines
10 to 24	12 h	6 h	4 h	3 h
25 to 49	4 h	2 h	1 - 2 / 3 h	1 h
50 to 99	2 h	1 h	40 min	30 min
100 to 500	1 h	30 min	20 min	15 min

(Interval = Auto)

DISPLAY AND CONTROLS

Type of Display: Vacuum fluoresecnt large-scaled display (5×7 dot matrix, blue), 2 lines (upper display ... 20 characters, larger size, lower display ... 28 characters, smaller size).

Data Display: Measured data (channel number or TAG, alarm status, measured value, engineering unit), bargraph, clock, alarm status, relay status, programming data, chart end, battery status, and recording format (TREND / LOGGING).

Control Section: Recording keys ... recording start / stop key, control keys for messages and manual printing. Setting keys ... keys for range and alarm setting (function keys, numerical keys) and display changing keys, key lock function ... any keys can be locked / unlocked except for those related to DISPLAY.

Number of Group Programmings: Up to 6 groups, programmable for range, alarm, printing format, tag number and MATH channel (C LOG).

CALCULATION (STANDARD)

Scaling:
Range ... DC V / TC / RTD
Input range .., each range within the measuring range
Scaling range ... −20000 to +20000
Deicmal point ... freely settable.

Difference Calculation (ΔT): Between any channels (within the same range).

Moving Average: For every 8 scans (ON / OFF is selectable for every channel).

MEMORY CARD

Memory Data: Setting data, measured data, communication input data and programmed parameter can be stored on a memory card (optional).

Sample Mode and Rate (Common Setting to All Channels):
In writing: Free mode ... sampling start by manual, sampling interval ... measurement interval or 1 / 2 / 5 / 10min., Trigger mode ... sampling start by trigger condition, sampling interval ... measurement interval or 1 / 2 / 5 / 10min.
In reading: Free mode, Trigger mode ... synchronized with measurement interval.

Memory Capacity: 512, 256 or 64K bytes.

Data Length (Common Setting to All Channels): 500 / 1,000 / 2,000 / 4,000 / 8,000 / 16,000 / 32,000 data / ch, data length ... 2 bytes / data.

Trigger Conditions: In Writing ... chart end detection alarm or external contact input (optional), In Reading ... alarm, external contact.

Pre-Trigger: 0 to 100%, in 10% steps.

Output: Outpus for communication and recording are possible.

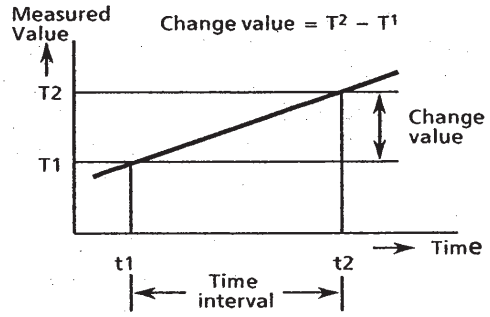
Battery Backup: Lithium battery, battery life ... about 2 years (256K, 512K bytes), about 4 years (64K bytes).

ALARMS

Number of Alarm Set Levels: Up to 6 levels / channel.

Alarm Types: High (H), low (L), high-rate of change (RH), low-rate of change (RL), delta high (ΔH), and delta low (ΔL).

Alarm Programming: All alarms are programmable via front-panel keys. * high-rate of change (time interval) : Measurement cycle × (1 to 15).



Display: The flashing display can be obtained for 30 point alarm status (ch. 1 to 30) + one common point for computing channels (ch. 31 to 60).

Recording:
Trend mode: CH. No., alarm types, and ON / OFF times in the right margin.
Logging mode: CH. No. and alarm types at the head of measured data.

Alarm Outputs (Optional): Up to 12 points (internal), up to 60 points [separate case (s)]. AND or OR output as well as REFLASH output can be specified. REFLASH alarm output (500ms) using internal alarm relay contact.

Alarm Acknowledgement: Pressing the ALARM ACK key stops the alarm display flashing and resets the dedicated common relay output.

Alarm Reset: Hold type relay output by pressing the ALARM RESET key.

CONSTRUCTION

Mounting: Flush panel mounting (may be inclined up to 30° backward from vertical).

Dimensions: Approx. 444 (W) × 288 (H) × 427 (D) mm, (17-1/2" × 11-3/8" × 16-7/8"). (HR2400)
Approx. 438 (W) × 266 (H) × 415 (D) mm, (17-1/4" × 10-1/2" × 16-5/16"). (HR2300)

Weight: Approx. 20kg (44.1 lbs). (HR2400)
Approx. 15kg (33.1 lbs). (HR2300)

POWER REQUIREMENTS

Power Supply: 90 to 250V AC (wide voltage range power supply), 50 and 60Hz (must be specified).
100 to 240V AC (wide voltage range power supply), 50 and 60Hz (must be specified) for / ES model.

Power Consumption: Approx. 80VA.

NORMAL OPERATING CONDITIONS

Ambient Temperature and Humidity Range:
0 to 50°C (32 to 122°F)
20 to 80% R.H. (0 to 40°C)
5 to 45% R.H. (40 to 50°C) (HR2400)
5 to 40°C (41 to 104°F), 20 to 80% R.H. (HR2300)

Input Source Resistance:
Less than 2kΩ (DC V & TC inputs),
less than 10Ω / wire (Pt100Ω),
less than 5Ω / wire (Pt50Ω),
less than 1Ω / wire (Cu10Ω).

GENERAL SPECIFICATIONS

Insulation Resistance: More than 20MΩ at 500V DC between terminals and case.

Dielectric Strength: Between power terminals and ground ; 1500V AC (50 / 60Hz) for one minute.
Between contact output terminals and ground ; 1500V AC (50 / 60Hz) for one minute. (HR2400)
1000V AC (50 / 60Hz) for one minute. (HR2300)
Between measurement terminals ; 1000V AC (50 / 60Hz) for one minute.

Battery-Backup Memory: Lithium battery, maintains all setting data for about 10 years (23°C ± 3°C, st'd model).

FAIL Alarm: FAIL lamp lights up when the recorder is in fail condition (FAIL output signal changes to non-inductive).

Chart End Detection: When the chart reaches near its end, "CHART" appears on the display. When recording is automatically stopped, the recorder goes into the monitoring status, and the CHART END output relay is energized (transfer contact).

Clock: With calendar function.

Key Lock Selector: Effective only for specified keys.

Internal Illumination: Fluorescent lamp. (HR2400 : standard, HR2300 : optional)

Input Terminals: Screw input terminal block (HR2400 : standard) and clamped input terminal block (HR2300 : optional). The input terminal block can be removed from the mainframe for easier wiring.

OPTIONAL FEATURES

GP-IB Interface (/GP-IB):
Conforms to IEEE St'd 488-1978. Talker Functions : measured value I / O (ASCII and binary, input is ASCII only), Set point I / O Listener Functions : Setting and controlling available other than for the following : Power ON / OFF, Key lock ON, CHART FEED , SET UP contents, and setting some of the memory functions.

RS-232C Interface (/RS232C):
Conforms to EIA RS-232C.
Mode : Measured value I / O (ASC II and binary, input is ASC II only), set point I / O (ASC II), memory data I / O (ASC II and binary), Setting and controlling available other than for the following : POWER ON / OFF, Key lock ON / OFF, CHART FEED, SET-UP contents, and setting some of the memory functions.

Computation (/MATH):
Types : +, −, ×, ÷, SQR (square root), ABS (absolute, value), LOG (common logarithm), EXP (exponential), Maximum, Minimum, Averages, Totals, Max. − Min., Standard deviation, Logic (AND, OR, NOT, XOR).
C LOG ... Computational processing in a group measured at the same time (total, max., min., average, standard deviation, and max − min).
T LOG ... Time series computational processing (max. 24 hours) for a channel (total, max., min., average, and max − min).
Number of channels ... Up to 30 channels, Trend and digital (logging) recording available, analog input of digital input through communications interfaces (/GP-IB or /RS232C) available.

Remote Control (/REM):
Through the contact input, start / stop, chart speed / interval change, manual printout, message recording (5 types), digital recording in the trend mode, writing on the memory card, and loading trigger available.
Input signal : TTL-level, open collector, and contact status.

Internal Alarm Output (/AK-□□, /EAI):
2 or 12 points, external box : Max. 30 or 60 points (external alarm box must be ordered separately), contact rating : 30V DC, 2A / 240V AC, 1A (HR2400 internal alarm) ; 24V DC, 0.5A (HR2300 internal alarm) ; 240V AC, 1A / 30V DC, 2A (external alarm box)
30V DC, 2A / 50V AC, 1A (for Model 4082 / ES
24V DC, 0.5A (for Model 3760 / ES)

STANDARD ACCESSORIES

Chart ... 1 chart (30m)
Ten-color ribbon ... 1 pc.
Fuse ... 1 pc. (1.25A, time lag)
Connector × 1 (HR2300), power supply cord (HR2300), panel mounting plate (HR2400).