

signal

**JOFRA™**

**NEW JOFRALOG  
 ACQUISITION SOFTWARE**

Model ASM

**Advanced Signal  
 Multi-scanner**

**Calibrate 24 temperature sensors**

Design your own calibration procedures - start calibrating and leave for other tasks. Save precious time and calibrate all sensors under exactly the same conditions

**Data-logging for multiple sensors**

Software for data logging of up to 24 sensors with user-defined interval

**Prepared for future expansions**

8 more channels for every ASM-800. Expand the system when required and save the investment until it is necessary

**Calibrate any temperature sensor**

Universal input to handle: 2-, 3-, 4-wire RTD's, TC's, transmitters, thermistors, thermo switches and voltage

**Integrate with JOFRA instruments**

Combine ASM with any JOFRA dry-block, JOFRA DTI reference thermometer or JOFRA ASC300 signal calibrator. Adds value to your existing JOFRA equipment

**Reference sensor input included**

Dedicate one input channel for your temperature reference sensor with an accuracy to 0.026°C / 0.047°F

**Reduce the human factor uncertainty**

Automatic procedures leave no space for operation errors

**Documentation made easy**

RS232 communication and JOFRACAL calibration software are included in the standard delivery

**PRODUCT DESCRIPTION**

The ASM series (Advanced Signal Multi-scanner) offers a unique time-saving and automatic solution to calibrate multiple temperature sensors simultaneously.

The ASM-800 series is designed for use where ever temperature measurement is critical and/or there is a need for traceable calibration documentation.

Easy, flexible and time-saving!



**Features**

The ASM series is a series of 8-channel scanners controlled by JOFRACAL software through a PC. Up to 3 ASM units can be stacked to calibrate up to 24 sensors at the same time. It can handle signals from 2-, 3- and 4 wire RTD's, TC's, transmitters, thermistors, temperature switches and voltage.

The solution includes the easy-to-use software JOFRACAL to set up, execute, print and save the valuable traceable calibration data - just connect the ASM to a PC through a RS232 cable.

JOFRACAL controls all JOFRA dry-block heating/cooling sources and includes the flexibility to use manual liquid baths, ice-points or dry-blocks. Connect the reference temperature sensor directly to the ASM-800 or use your existing JOFRA temperature reference device.

Furthermore the JOFRALOG software allows the user to use the ASM scanner as a data-logging device for up to 24 sensors.

### Basic versions

The ASM-series is available in 3 versions depending on the kind of sensors to be measured.

ASM-801 has 8 universal plugs. This is a fixed screw terminal solution used to measure RTD's, TC's, mA, voltage, ohm, and transmitters. It measures the cold junction (CJ) temperature for each channel and is able to supply a very accurate cold junction (CJ) temperature compensation.

ASM-802 has 8 small TC plugs for measurement of TC sensors. This model also measures the cold junction (CJ) temperature for each channel and is able to supply a very accurate cold junction (CJ) temperature compensation.

ASM-803 has 8 LEMO plugs, which are primarily for measurement of RTD sensors. This solution makes it possible to measure current, voltage and ohm. It has built-in loop power supply for each channel.

### Models

The ASM multi-scanner is made in an A and a B model. The ASM B model is the complete solution with integrated scanner and high accuracy multi signal measuring circuits. The ASM A model is less expensive and is designed to add 8 channel scanning capabilities to an existing instrument. The A model therefore needs the measuring capabilities from a JOFRA dry-block ATC B model, JOFRA ASC300 signal calibrator, DTI-1000 reference thermometer or an ASM B model.

#### A model

The A model use the measuring circuit of an existing instrument. This means that the normal set-up of the measuring equipment is used, and the multi-scanner then makes it possible to calibrate up to 8 sensors simultaneously. The built-in cold junction temperature measuring circuit ensures high accuracy when calibrating thermocouples. The A model is also capable of working without the JOFRACAL with a manual channel selector at the back.

The A model may transmit an analogue signal of up to 8 sensors to one connected measuring device. It is able to transmit signals up to 30VDC, 30 mA.

#### B model

The B model has the same functions as the A model, but it differs as it is not necessary to include a measuring instrument in the set-up, as the multi-scanner has built-in measurement capabilities.

The most important advantage of the B model is the fact that it is possible to obtain huge reductions in time of the calibration procedure. The B model is able to perform several measurements each second, whereas the A model as an example will spend approx. 15 seconds on each measurement, when connected to an ATC B model.

The B models is able to measure voltage up to 10V, resistance up to 4KΩ and current up to 24mA.

### True Ohm Measurement

The ASM-801 and ASM-803 employ state-of-the-art DC measuring techniques. To achieve high accuracy, the measuring principle used by the ASM is True Ohm Measurement thus eliminating the EMF from cables, sockets, and sensors.

True Ohm Measurement is a proven method to achieve accurate compensation for errors induced by thermal effects. The resistance is measured through the 4-wire system at 0.8 mA, after which the instrument takes a reading without any applied current. The second reading is the "error EMF".

### Measurement of up to 24 sensors at the same time

For both ASM models it is possible to connect up to 3 ASM multi-scanners, enabling you to measure up to 24 sensors simultaneously. Both models are able to perform / transmit the following measurements: 2-, 3- and 4-wire RTD, TC signals with or without cold junction (CJ) compensation, thermistors, transmitters, current, voltage, and ohm sources / loads.

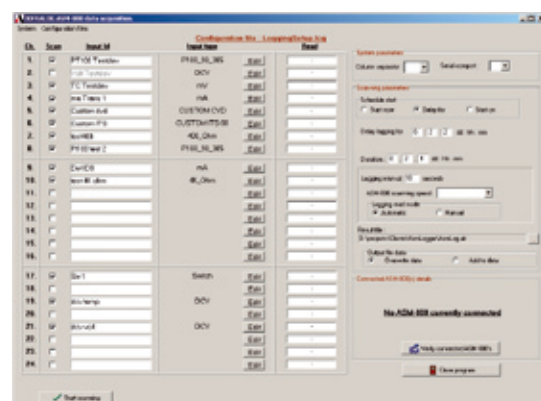
ASM-801 A/B and ASM 803 A/B both have built-in 24 V loop power for 4-20 mA transmitter.

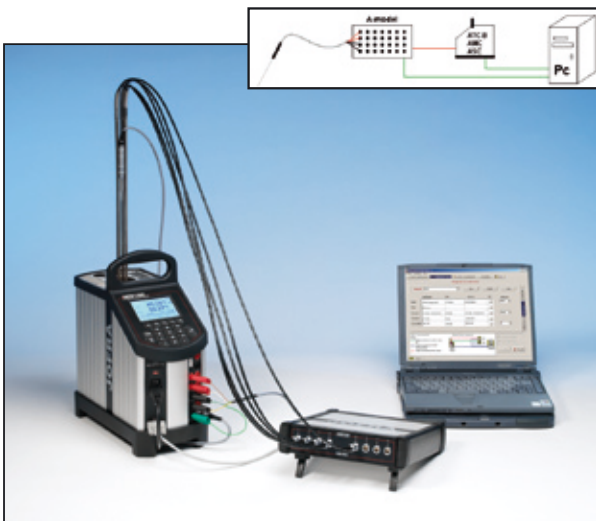
### Data-logging for multiple sensors

The data acquisition software JOFRALOG allows the user to utilize the ASM multi-scanner as a data-logging device for multiple sensors. The JOFRALOG program allows the configuration and execution of a logging procedure collecting data from up to 24 sensors saving the data in a format compatible to Microsoft Excel.

JOFRALOG works with a ASM B model for collecting data from 8 channels. By adding 1 og 2 ASM A models, the number of channels may be expanded to 16 or 24. When the user has defined a scanning job, the user may store the configuration including sensor definitions for every channel in a configuration file. Whenever required the information may be loaded and reused. On start-up the previous configuration used is always loaded automatically saving the user a lot of time. Furthermore the uploaded information will be checked against the configuration to determine any conflicts.

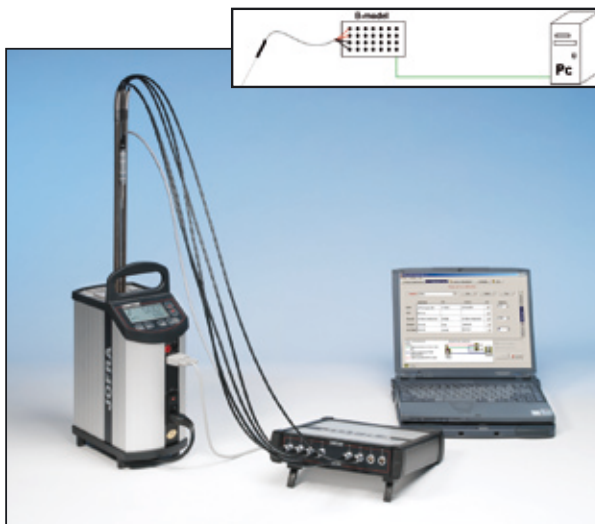
JOFRALOG may be downloaded from [www.jofra.com](http://www.jofra.com).



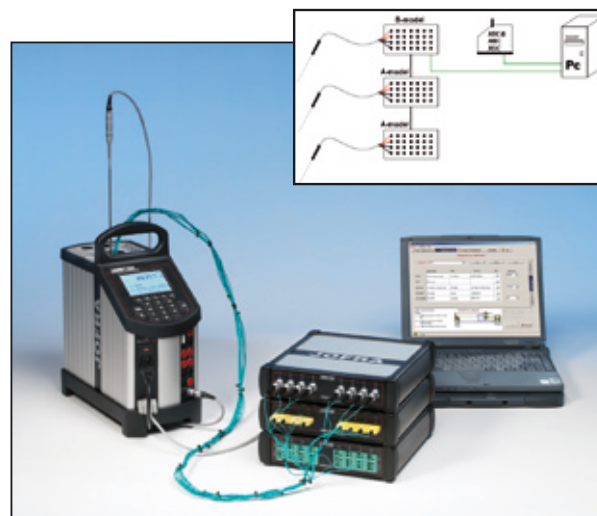


Picture 1: ASM-803 A connected to the inputs of a JOFRA ATC B model and controlled by JOFRACAL.

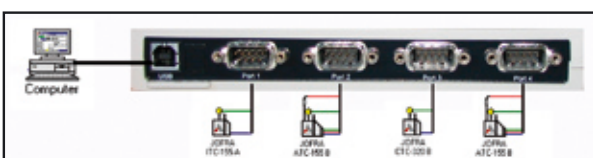
**Combine the ASM signal multi-scanner with any of your existing JOFRA dry-block or liquid bath calibrators. You can also use your JOFRA DTI reference thermometer or even the JOFRA ASC300 signal calibrator, which adds further value to your existing JOFRA equipment.**



Picture 2: ASM-803 B performing its own measurements in a JOFRA ITC-320 A including an STS reference sensor in channel one all controlled by JOFRACAL.



Picture 3: 2 ASM A models connected to the ASM B model, in order to obtain 24 channels. In this set-up the JOFRA ATC B model is used as a dry-block with the reference sensor connected to the reference input of the ATC. All controlled by JOFRACAL.



Edgeport converter - Order number 125002

The edgeport converter converts one USB port to four RS232 ports without external power supply. Tested with JOFRA calibrators and JOFRACAL calibration software

## JOFRACAL CALIBRATION SOFTWARE

JOFRACAL calibration software ensures easy calibration of RTD's, thermocouples, transmitters, thermoswitches, pressure gauges and pressure switches. JOFRACAL can be used with JOFRA DPC-500, APC, CPC and IPI pressure calibrators, all JOFRA temperature calibrators, as well as JOFRA AMC910, ASC300 multi signal calibrator and ASM-800 signal multi scanner. When used with JOFRA ASM-800 signal multi scanner, JOFRACAL can perform a simultaneous semi automatic calibration on up to 24 pressure and/or temperature devices under test in any combination.

JOFRACAL software controls the complete calibration procedure, stores the results and provides a calibration audit trail through hard-copy certificates. All calibration data are stored for each sensor to monitor drift and optimise recalibration intervals. A scheduler feature allows planning of future calibrations.

Using JOFRACAL together with the ASM multi-scanner allows the user to customize all calibration routines. The software is easy-to-use so you do not have to be a programmer to configure your own calibration procedures. The software features prompts, menus, and help functions that guide you through the configuration process.

If up to three ASM multi-scanners are connected, the software enables the instruments to measure sensors of the same type simultaneously. When working with the ASM series, the sensors connected need to be of the same type. Only exception being channel 1, which can always be used for the temperature reference sensor.

Please find more information about JOFRACAL calibration software in specification sheet SS-CP-2510, which may be found at [www.jofra.com](http://www.jofra.com). It is also possible to download JOFRACAL from the web-site.

## REQUIREMENTS JOFRACAL

### Minimum hardware requirements:

- Intel® Pentium® II 1.4 GHz processor.
- 64MB RAM (128MB recommended)
- 80MB free disk space on hard disk (120MB recommended) prior to installation
- Standard VGA (800x600, 256 colours). 1024x768 recommended.
- CD-ROM drive for installation of program
- 1 or 2 free RS-232 serial ports, depending on configuration

### Minimum software requirements:

- Microsoft Windows® 98, Microsoft Windows® NT 4.0, Microsoft Windows® 2000, Microsoft Windows® ME, Microsoft Windows® XP, Vista.
- System fonts: MS Sans Serif and Arial



## JOFRA STS REFERENCE SENSORS

The ASM series handles signals from 2-, 3- and 4 wire RTD's, TC's, transmitters, thermistors, temperature switches and voltage.

All sensors under test are compared to a temperature reference sensor. The reference sensor can be the internal reference sensor in a dry-block or an external reference sensor, which is connected to channel one on the ASM multi-scanner.



To get an ideal reference system, JOFRA offers a range of reference sensors. All JOFRA Superior Temperature Standard sensors are economical and offer fast response times, low immersion depths, compact physical sizes, and specified low drift rates: even at high temperatures. These are all important considerations when selecting a reference sensor.

Please find more information in accessory sheet AS-CP-2210, which may be found at [www.jofra.com](http://www.jofra.com)

## SYSTEM ACCURACY - STS SENSOR

- 50 to 400°C / -58°F to 752°F .... ±0.050°C / ±0.090°F 1) 2)
- 50 to 400°C / -58°F to 752°F ..... ±0.070°C / ±0.126°F 1) 3)
- 50 to 650°C / -58°F to 1202°F ... ±0.080°C / ±0.144°F 1) 2)
- 50 to 650°C / -58°F to 1202°F .... ±0.110°C / ±0.198°F 1) 3)

Note: System accuracy using STS-100 sensor, 12 months use - order system calibration for full documentation / traceability

- 1) Specified at 95% confidence interval k=2, over full range, including 1 calibration uncertainty, excluding 1 LSD (Least Significant Digit).
- 2) Excl. sensor drift (please see long term stability at page 5)
- 3) Incl. sensor drift (please see long term stability at page 5) after 100 hours at max. temperature.



## FUNCTIONAL SPECIFICATIONS

### Power supply

Power supply ..... External AC/DC adapter  
Input ..... 90 – 254V, 45 – 65Hz  
Output ..... 30V  $\pm 2\%$  regulated DC, max. 30W

### Scanning rate

Scanning rate ..... Max. 5 channels per seconds

## PHYSICAL SPECIFICATIONS

### Instrument dimensions

L x W x H ..... 250 x 249 x 69 mm (9.8 x 9.8 x 2.7 in)

### Instrument weight

Net weight ..... 2.3 kg (5.07 lb)

### Shipping (including carrying case)

Weight ..... 6.3 kg (13.9 lb)  
Size: L x W x H ..... 350 x 560 x 180 mm (13.8 x 22.1 x 7.1 in)

### Shipping (without carrying case)

Weight ..... 4.4 kg (9.7 lb)  
Size: L x W x H ..... 350 x 560 x 180 mm (13.8 x 22.1 x 7.1 in)

### Miscellaneous

Serial data interface ..... RS232  
Specification temperature ..... 20 to 26°C (68 to 79°F)  
Operating (ambient) temperature ..... 0 to 40°C (32 to 104°F)  
Storage (ambient) temperature ..... -20 to 50°C (-4 to 122°F)  
Humidity ..... 0 to 90% RH @ 30°C  
CE Conformity ..... EN61326

## INPUT SPEC'S (A MODELS ONLY)

All input specifications apply to the instrument connected

### Transmitter supply

Output voltage ..... 24VDC +10%  
Output current ..... Maximum 28 mA

### Accuracy automatic cold junction compensation

ASM-801/802  $\pm 0.20^\circ\text{C}$  ( $\pm 0.36^\circ\text{F}$ ) @ ambient temperature  
..... 20 to 26°C (68 to 79°F)  
ASM-803  $\pm 0.50^\circ\text{C}$  ( $\pm 0.90^\circ\text{F}$ ) @ ambient temperature  
..... 20 to 26°C (68 to 79°F)  
Temperature drift outside 20 to 26°C ..... 0.05°C/°C 0.05°F/°F

### Input specifications

A-models when used with other equipment \*

RTD 4-wire ..... 2.5 ppm rdg. (0-400 ohm)  
..... 15 ppm rdg. (400-4000 ohm)  
RTD 3-wire ..... 2.5 ppm rdg. + 50 mohm (0-400 ohm)  
..... 15 ppm rdg. + 50 mohm (400-4000 ohm)  
mA ..... 1 ppm rdg. (0-24 mA)  
MV, V ..... 2 $\mu$ V

\* Accuracies from the connected instruments has to be added

## INPUT SPEC'S (B MODELS ONLY)

### Transmitter supply

Output voltage ..... 24VDC +10%  
Output current ..... Maximum 28 mA

### Transmitter input mA

Range ..... 0 to 24 mA  
Accuracy (12 months) .....  $\pm 0.01\%$  Rdg. +0.01% F.S.

### Voltage input VDC

Range ..... 0 to 12 VDC  
Accuracy (12 months) .....  $\pm 0.005\%$  Rdg. +0.01% F.S.

### Switch input

Switch dry contacts  
Test voltage ..... Maximum 2.5 VDC  
Test current ..... Maximum 0.8 mA

### RTD input specifications

Signal type ..... 2-, 3-, 4-wire true ohm RTD input  
Signal range ..... 0-400  $\Omega$  (PT10/PT50/PT100)  
Accuracy (12 months) .....  $\pm 0.002\%$  Rdg. +0.002% F.S.  
Signal range ..... 0-4000  $\Omega$  (PT200/PT500/PT1000)  
Accuracy (12 months) .....  $\pm 0.002\%$  Rdg. +0.005% F.S.

For 3-wire input add 50 m $\Omega$  assuming all three RTD leads are matched. For 2-wire add 100 m $\Omega$ .

### Thermocouple specifications

Signal range ..... -10mV – 78 mV  
Accuracy .....  $\pm (0.005\%$  of rdg. + 0.005% of F.S.)

### Accuracy automatic cold junction compensation

ASM-801/802  $\pm 0.20^\circ\text{C}$  ( $\pm 0.36^\circ\text{F}$ ) @ ambient temperature  
..... 20 to 26°C (68 to 79°F)  
ASM-803  $\pm 0.50^\circ\text{C}$  ( $\pm 0.90^\circ\text{F}$ ) @ ambient temperature  
..... 20 to 26°C (68 to 79°F)  
Temperature drift outside 20 to 26°C ..... 0.05°C/°C  
(0.05°F/°F)

4-wire RTD Type	Temperature range				12 months accuracy	
	°C		°F		°C	°F
	From	To	From	To		
<b>Pt10</b>	-200	-80	-328	-112	0.198	0.357
alpha 385	-80	0	-112	32	0.210	0.378
	0	100	32	212	0.224	0.403
	100	155	212	311	0.225	0.405
	155	320	311	608	0.234	0.422
	320	420	608	788	0.250	0.450
	420	660	788	1220	0.263	0.473
	660	800	1220	1472	0.292	0.525
<b>Pt50</b>	-200	-80	-328	-112	0.042	0.076
alpha 385	-80	0	-112	32	0.046	0.083
	0	100	32	212	0.051	0.091
	100	155	212	311	0.052	0.093
	155	320	311	608	0.057	0.102
	320	420	608	788	0.062	0.112
	420	660	788	1220	0.069	0.124
	660	800	1220	1472	0.078	0.141
<b>Pt100</b>	-200	-80	-328	-112	0.023	0.041
alpha 385	-80	0	-112	32	0.026	0.046
	0	100	32	212	0.029	0.052
	100	155	212	311	0.030	0.054
	155	320	311	608	0.034	0.062
	320	420	608	788	0.038	0.069
	420	660	788	1220	0.044	0.080
	660	800	1220	1472	0.052	0.093
<b>Pt200</b>	-200	-80	-328	-112	0.247	0.445
alpha 385	-80	0	-112	32	0.262	0.471
	0	100	32	212	0.278	0.500
	100	155	212	311	0.279	0.502
	155	320	311	608	0.290	0.522
	320	420	608	788	0.309	0.556
	420	660	788	1220	0.323	0.582
	660	800	1220	1472	0.358	0.645
<b>Pt500</b>	-200	-80	-328	-112	0.101	0.182
alpha 385	-80	0	-112	32	0.108	0.194
	0	100	32	212	0.116	0.208
	100	155	212	311	0.117	0.210
	155	320	311	608	0.123	0.222
	320	420	608	788	0.133	0.239
	420	660	788	1220	0.141	0.254
	660	800	1220	1472	0.158	0.285

<b>Pt1000</b>	-200	-80	-328	-112	0.052	0.094
alpha 385	-80	0	-112	32	0.056	0.102
	0	100	32	212	0.062	0.111
	100	155	212	311	0.063	0.113
	155	320	311	608	0.068	0.122
	320	420	608	788	0.074	0.133
	420	660	788	1220	0.081	0.145
	660	800	1220	1472	0.092	0.165
<b>M50</b>	-200	-80	-328	-112	0.039	0.070
alpha 428	-80	0	-112	32	0.042	0.076
	0	100	32	212	0.045	0.081
	100	155	212	311	0.045	0.081
	155	200	311	392	0.046	0.083
<b>M100</b>	-200	-80	-328	-112	0.021	0.038
alpha 428	-80	0	-112	32	0.023	0.041
	0	100	32	212	0.026	0.047
	100	155	212	311	0.026	0.047
	155	200	311	392	0.027	0.049



The ASM-800 will fit into a lot of process industries and especially pharmaceutical, oil & gas and power plants. Original equipment manufacturers (OEM) will also benefit from calibrating and documenting multiple temperature sensors before final installation.

TC Type	Temperature range				12 month accuracy	
	°C		°F		°C	°F
	From	To	From	To		
B	250	320	482	608	1.31	2.35
	320	420	608	788	0.99	1.77
	420	660	788	1220	0.65	1.17
	660	800	1220	1472	0.56	1.01
	800	1000	1472	1832	0.44	0.78
	1000	1200	1832	2192	0.41	0.74
	1200	1400	2192	2552	0.39	0.70
	1400	1600	2552	2912	0.38	0.69
	1600	1820	2912	3308	0.40	0.72
E	-250	-200	-418	-328	0.74	1.34
	-200	-100	-328	-148	0.18	0.32
	-100	0	-148	32	0.09	0.17
	0	155	32	311	0.06	0.11
	155	320	311	608	0.06	0.12
	320	420	608	788	0.07	0.12
	420	660	788	1220	0.08	0.14
	660	800	1220	1472	0.09	0.16
J	-210	-100	-346	-148	0.23	0.41
	-100	0	-148	32	0.10	0.18
	0	155	32	311	0.08	0.14
	155	320	311	608	0.09	0.16
	320	420	608	788	0.09	0.17
	420	660	788	1220	0.09	0.17
	660	800	1220	1472	0.09	0.17
	800	1000	1472	1832	0.11	0.21
	1000	1200	1832	2192	0.13	0.23
K	-250	-200	-418	-328	0.94	1.69
	-200	-100	-328	-148	0.27	0.49
	-100	0	-148	32	0.14	0.24
	0	155	32	311	0.10	0.19
	155	320	311	608	0.11	0.20
	320	420	608	788	0.11	0.20
	420	660	788	1220	0.13	0.23
	660	800	1220	1472	0.14	0.24
	800	1000	1472	1832	0.15	0.28
	1000	1200	1832	2192	0.17	0.31
N	-250	-200	-418	-328	1.37	2.47
	-200	-100	-328	-148	0.41	0.74
	-100	0	-148	32	0.20	0.35
	0	155	32	311	0.15	0.27
	155	320	311	608	0.13	0.23
	320	420	608	788	0.12	0.22
	420	660	788	1220	0.13	0.23
	660	800	1220	1472	0.14	0.24
	800	1000	1472	1832	0.15	0.27
	1000	1200	1832	2192	0.16	0.29
1200	1300	2192	2372	0.17	0.31	

TC Type	Temperature range				12 month accuracy	
	°C		°F		°C	°F
	From	To	From	To		
R	-50	0	-58	32	1.30	2.35
	0	155	32	311	0.78	1.40
	155	320	311	608	0.47	0.84
	320	420	608	788	0.40	0.73
	420	660	788	1220	0.39	0.70
	660	800	1220	1472	0.35	0.63
	800	1000	1472	1832	0.36	0.64
	1000	1200	1832	2192	0.34	0.61
	1200	1400	2192	2552	0.34	0.60
	1400	1600	2552	2912	0.35	0.62
S	-50	0	-58	32	0.98	1.76
	0	155	32	311	0.78	1.40
	155	320	311	608	0.49	0.89
	320	420	608	788	0.45	0.81
	420	660	788	1220	0.41	0.73
	660	800	1220	1472	0.40	0.72
	800	1000	1472	1832	0.39	0.70
	1000	1200	1832	2192	0.38	0.69
	1200	1400	2192	2552	0.38	0.69
	1400	1600	2552	2912	0.39	0.71
T	-250	-200	-418	-328	0.65	1.17
	-200	-100	-328	-148	0.27	0.49
	-100	0	-148	32	0.15	0.26
	0	155	32	311	0.10	0.18
	155	320	311	608	0.08	0.15
	320	400	608	752	0.08	0.14



## ORDERING INFORMATION

Order number	Description
	<b>Base model number</b>
ASM801	ASM-801 series (with 8 universal screw plugs)
ASM802	ASM-802 series (with 8 TC plugs)
ASM803	ASM-803 series (with 8 LEMO plugs)
	<b>Model version</b>
A	Basic model no built-in measuring circuit
B	Including built-in measuring circuit
	<b>Calibration certificate</b>
F	Traceable certificate
H	Accredited certificate
	<b>Options</b>
C	Carrying case

### ASM801BFC Sample order number

JOFRA ASM-801 B with standard accessories, traceable certification and carrying case.

When ordering an A model or you want to connect several ASM scanners please remember to order connection cables (see below).

## STANDARD DELIVERY

- ASM signal multi-scanner (user specified)
- Mains adapter
- RS232 cable
- JOFRACAL software
- JOFRALOG software (B models only)
- Reference manual
- Screw driver (ASM-801 only)

## ACCESSORIES

### Connection cables:

- |        |   |
|--------|---|
| 122823 | Cable with banana / LEMO connection (ASM-A to ATC / ASC300 - RTD / Volt / mA)         |
| 125534 | Cable (1150 mm) with male LEMO / LEMO connection (ASM-A to AMC910 / DTI-1000 - RTD)   |
| 125587 | Cable with minicompensation / LEMO connection (ASM-A to ATC / ASC300 / AMC910 - TC)   |
| 125618 | Kit with RS232 cable and cable (650 mm) with male LEMO / LEMO connection (ASM to ASM) |

### Other accessories:

- |        |   |
|--------|---|
| 120517 | Thermocouple male plug type K (ASM-802)   |
| 120514 | Thermocouple male plug type N (ASM-802)   |
| 120515 | Thermocouple male plug type T (ASM-802)   |
| 120519 | Thermocouple male plug type TYPE Cu-Cu (ASM-802)  |
| 125620 | LEMO connection with strain relief (ASM-803)  |
| 60E151 | 1 meter, 4 Core cable with shield for Pt100 (ASM-803)   |
| 125002 | Edgeport converter with 4 RS232 ports. Connected and powered by the USB connection to the PC. Tested with JOFRA calibrators |

**AMETEK**<sup>®</sup>  
CALIBRATION INSTRUMENTS

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**AMETEK Calibration Instruments** is one of the world's leading manufacturers and developers of calibration instruments for temperature, pressure and process signals as well as for temperature sensors both from a commercial and a technological point of view.

**JOFRA Temperature Instruments**  
Portable precision thermometers. Dry-block and liquid bath calibrators: 4 series, with more than 25 models and temperature ranges from -90° to 1205°C / -130° to 2200°F. All featuring speed, portability, accuracy and advanced documenting functions with JOFRACAL calibration software.

**JOFRA Pressure Instruments**  
Convenient electronic systems ranging from -1 to 1000 bar (25 inHg to 14,500 psi) - multiple choices of pressure ranges, pumps and accuracies, fully temperature-compensated for problem-free and accurate field use.

**JOFRA Signal Instruments**  
Process signal measurement and simulation for easy control loop calibration and measurement tasks - from handheld field instruments to laboratory reference level bench top instruments.

**JOFRA / JF Marine Instruments**  
A complete range of calibration equipment for temperature, pressure and signal, approved for marine use.

**FP Temperature Sensors**  
A complete range of temperature sensors for industrial and marine use.

**M&G Pressure Testers**  
Pneumatic floating-ball or hydraulic piston dead weight testers with accuracies to 0.015% of reading.

**M&G Pumps**  
Pressure generators from small pneumatic "bicycle" style pumps to hydraulic pumps generating up to 1,000 bar (15,000 psi).

*...because calibration is  
a matter of confidence*