

Japanese Reliable Temperature Sensor listed in EPPL

September. 25. 2013

**GUIDANCE & PROPULSION DIVISION
AEROSPACE SYSTEMS
MITSUBISHI HEAVY INDUSTRIES,LTD.**

Contents

- ▣ Product Overview
- ▣ History of our Sensor
- ▣ Method of Temperature Measurements
- ▣ Details of our temperature sensor
- ▣ Quality assurance, Manufacturing and Supply

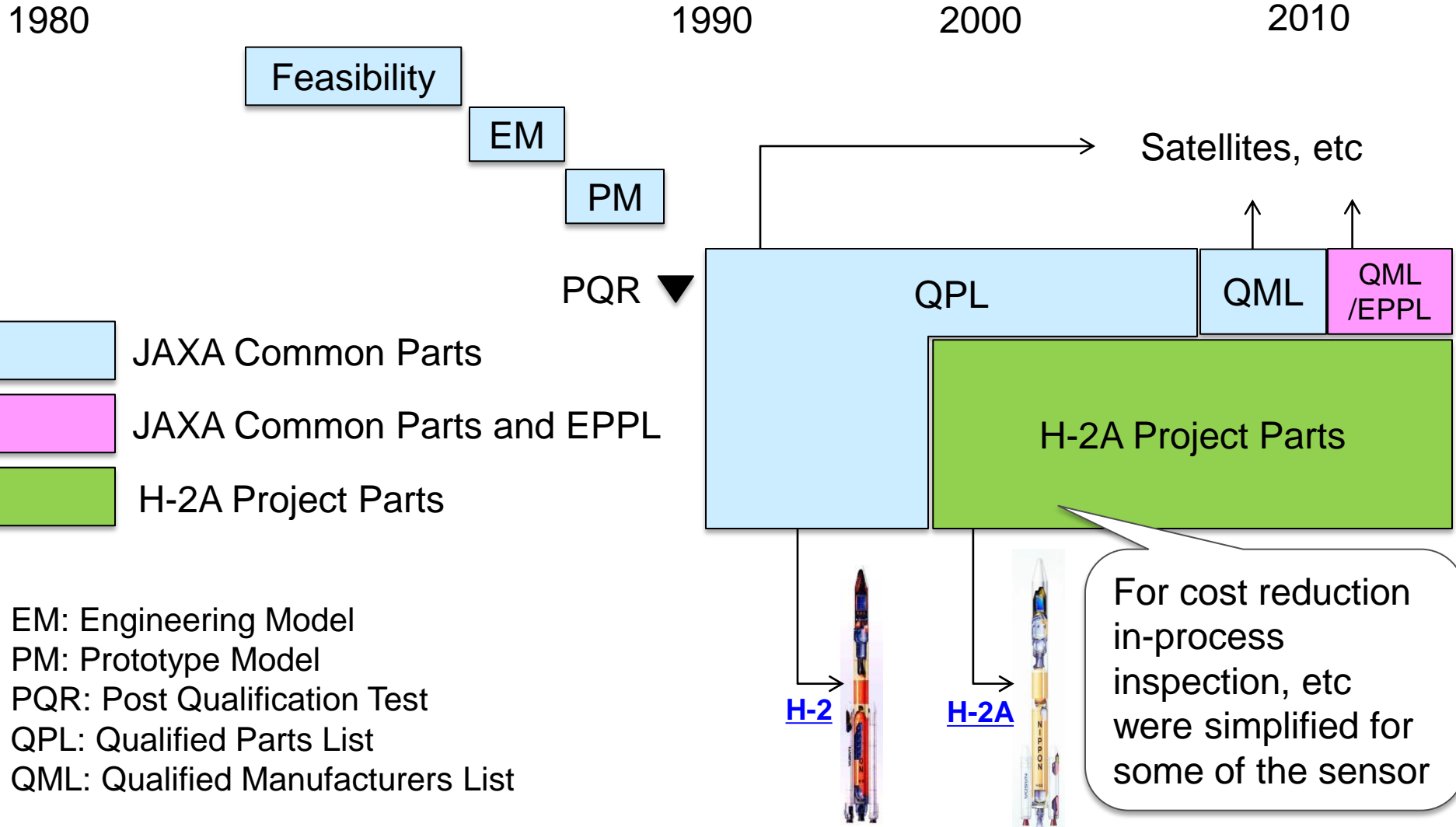
- Temperature sensor for space applications
 - For launch vehicle
 - For satellite
 - For Space vehicle and so on
- Experience
 - Providing since 1990
 - Annual delivery quantity ~700
- Feature
 - Robust to environment
Vibration, Mechanical shock
and so on
 - High stability and repeatability
(0.2°C)



Contents

- Product Overview
- History of our Sensor
- Method of Temperature Measurements
- Details of our Temperature Sensor
- Quality assurance, Manufacturing and Supply

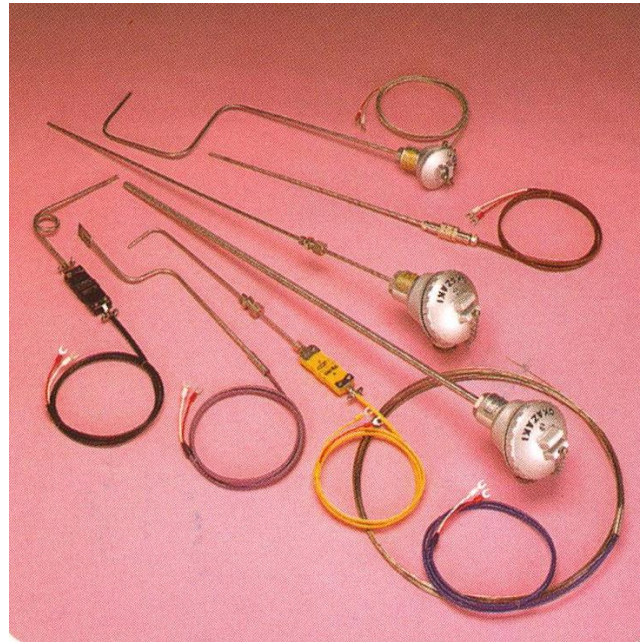
History of our Sensor



Contents

- Product Overview
- History of our Sensor
- Method of Temperature Measurements
- Details of our Temperature Sensor
- Quality assurance, Manufacturing and Supply

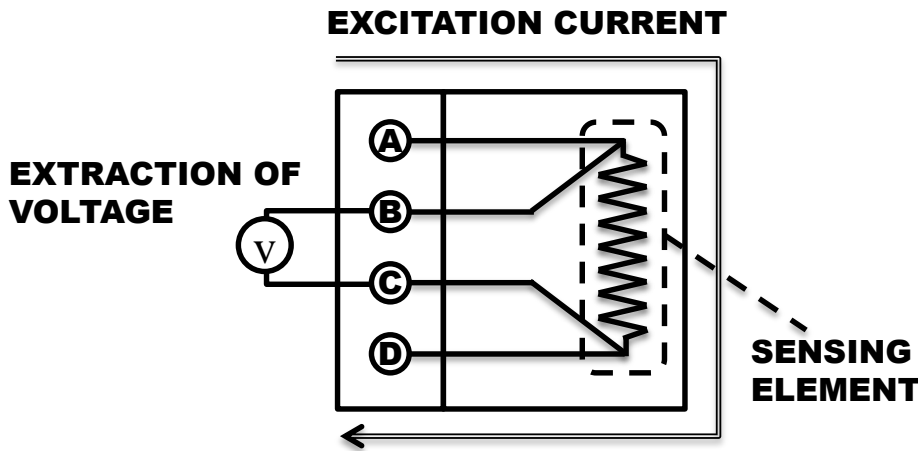
- Thermocouple
 - Without external excitation
 - Low cost
 - Wide temperature range
 - Accuracy
 - Repeatability



Typical figure of thermocouple

- Resistance Temperature Detector (RTD)
 - Accuracy
 - Repeatability

That of our sensor 0.2°C or less probe sheath type only.



Typical wiring diagram of RTD



Typical figure of RTD

We had adopted RTD for its accuracy and repeatability.

Contents

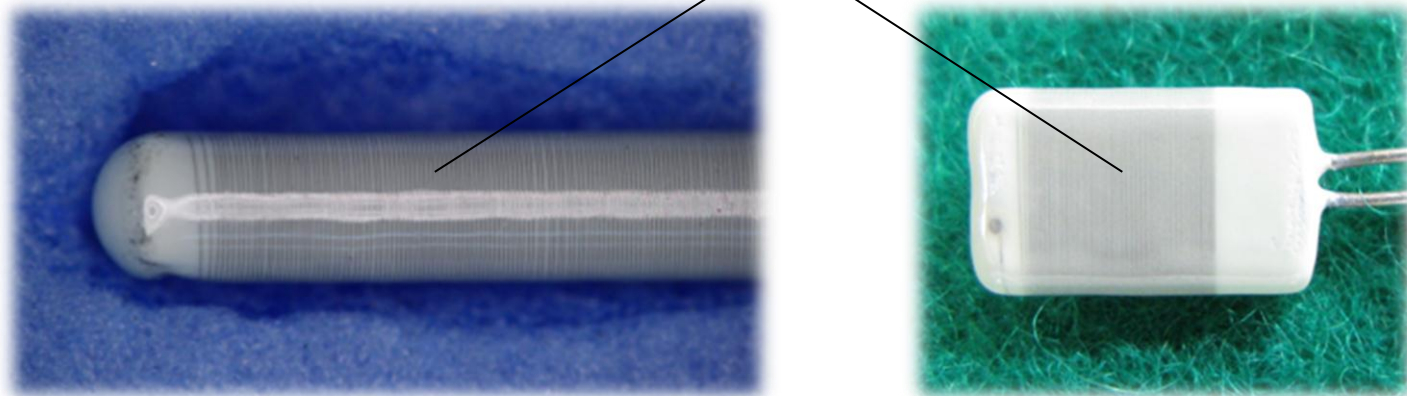
- Product Overview
- History of our Sensor
- Method of Temperature Measurements
- Details of our Temperature Sensor
- Quality assurance, Manufacturing and Supply

【Technology】

Sensing element consists of

- Fine coiled wire coated with glass
- Mineral insulated cable
- Insulator if necessary

Fine coiled wire; Platinum



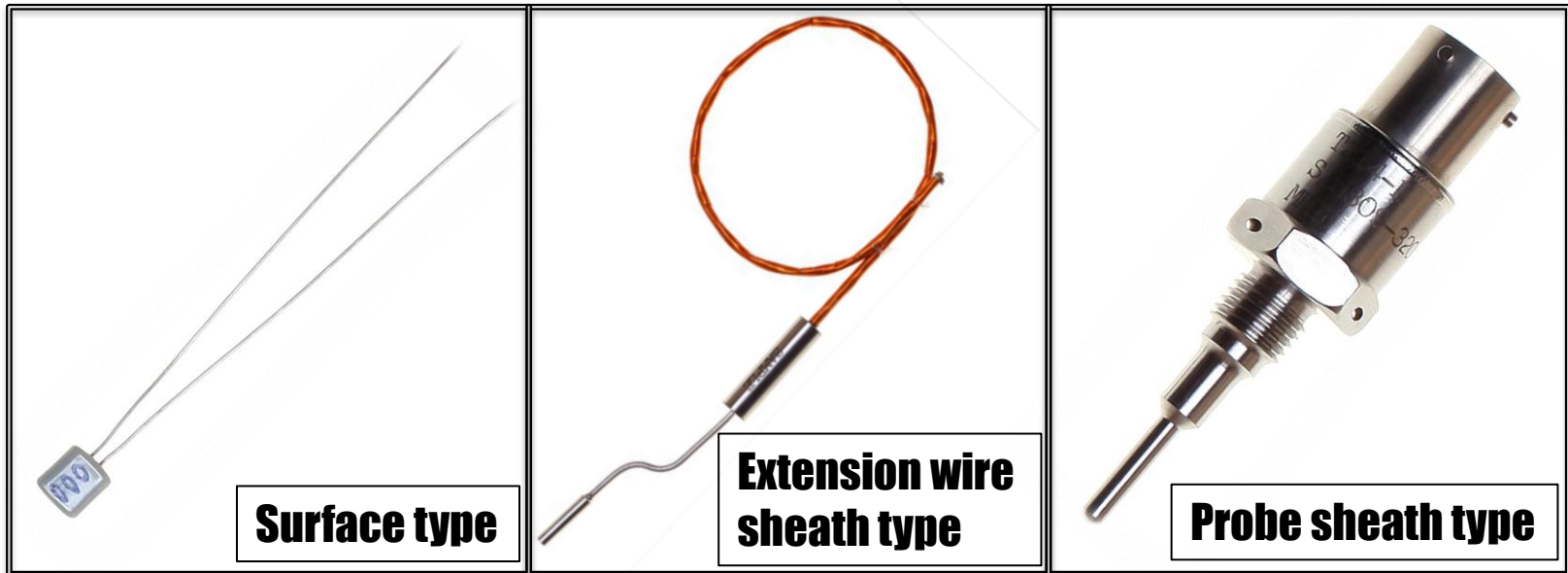
【sensing element】

Details of Our Temperature Sensor

【Line-Up】

We have three types of sensor

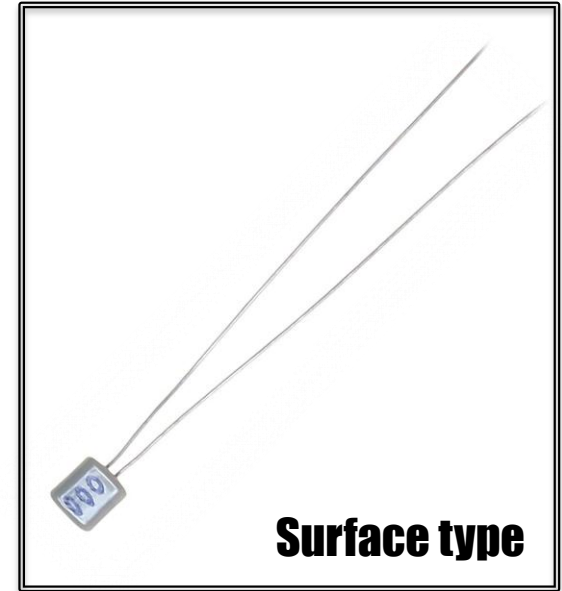
- Surface type
- Extension wire sheath type
- Probe sheath type



Details of Our Temperature Sensor

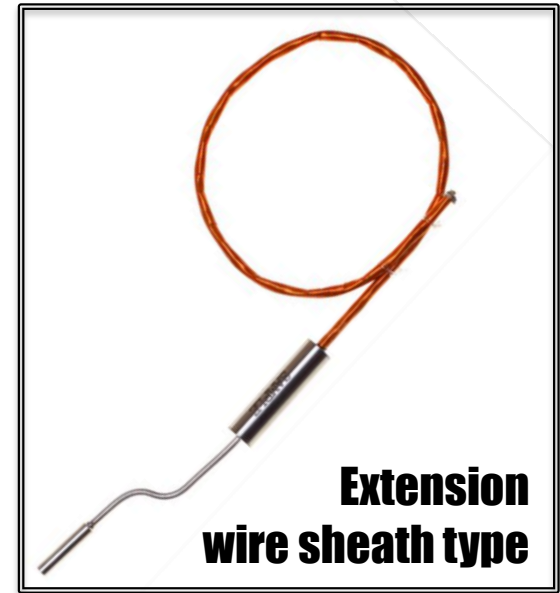
- Surface type used for
 - Important components
 - Cryogenic fluid ;LH2,LOX and so on

		Measured temperature range	repeatability	Nominal resistance
Surface type	90 series	-260°C to +400°C	0.65°C or less	2000±4Ω (at 0°C)
	91 series	-196°C to +400°C	0.60°C or less	500±1Ω (at °C)



Details of Our Temperature Sensor

- Extension wire sheath type used for
 - Corrosive fluid; hydrazine, etc
 - High temperature ~930 °C
 - As level sensor
- ; Similar types of sensor used for H-2A launch vehicle as level and depletion sensor.



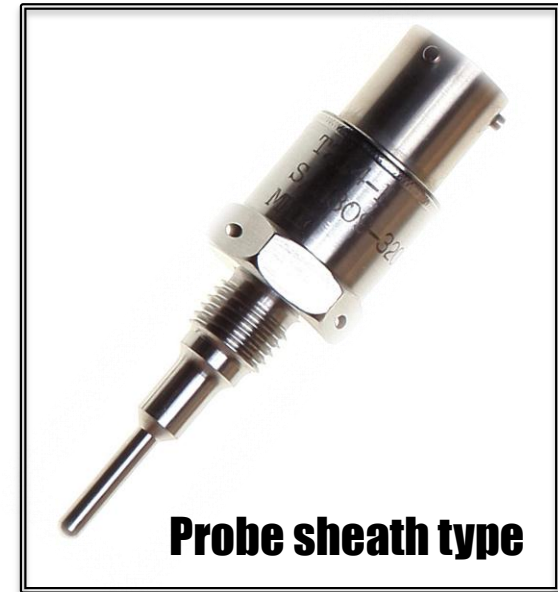
		Measured temperature range	repeatability	Nominal resistance
Extension wire sheath type	70 series	-18°C to +930°C	3.83 °C or less	100±0.5Ω (at 0°C)
	71 series	-80°C to +430°C	0.754°C or less	500±2.5Ω (at 0°C)

H-2A depletion sensor

*Journal of High Temperature Society
Vol.34 No.5

Details of Our Temperature Sensor

- Probe sheath type used for
 - Pressurized place
Under 6.865 MPa
 - Corrosive and cryogenic fluid
LH2, LOX, hydrazine and so on



	Measured temperature range	repeatability	Nominal resistance
Probe sheath type	-260°C to +135°C	0.2°C or less	1000±2Ω (at 0°C)

Details of Our Temperature Sensor

【Typical Performance】

Item		Measured temperature range	Compatible special fluid	repeatability	Random vibration	shock	Nominal resistance
Surface type	90 series	-260°C to +400°C	Cryogenic fluid	0.65°C or less	45Grms	2000G*1	2000±4Ω (at 0°C)
	91 series	-196°C to +400°C	Cryogenic fluid	0.60°C or less	43~90Grms	3400G*2	500±1Ω (at °C)
Extension wire sheath type	70 series	-18°C to +930°C	Corrosive fluid	3.83 °C or less	40.7Grms	2000G*1	100±0.5Ω (at 0°C)
	71 series	-80°C to +430°C	Corrosive fluid	0.754°C or less	40.7Grms	2000G*1	500±2.5Ω (at 0°C)
Probe sheath type		-260°C to +135°C	Corrosive fluid	0.2°C or less	43Grms	2000G*1	1000±2Ω (at 0°C)

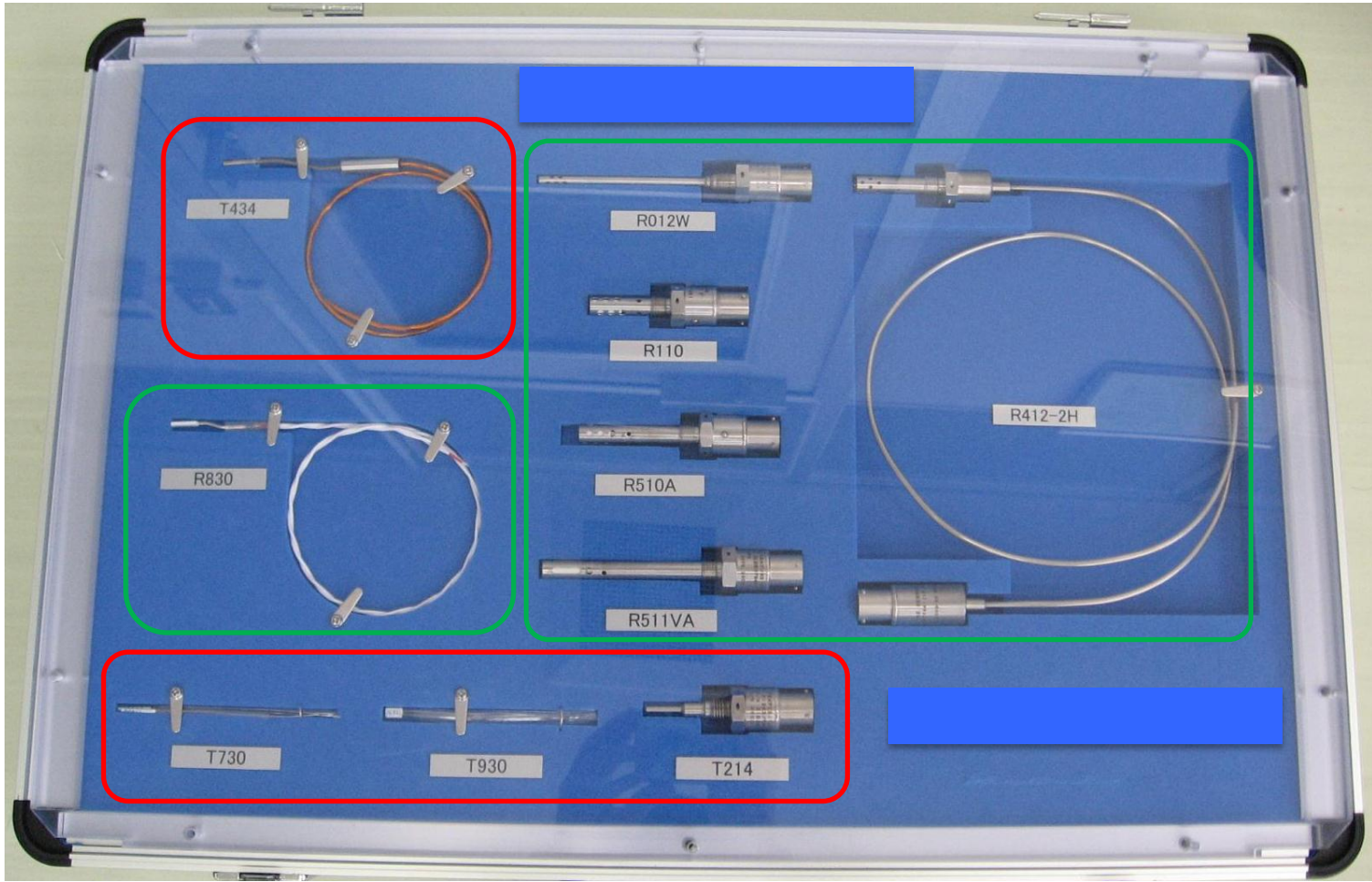
*1 SRS@4000Hz *2Half sine 0.2ms

“For more detailed information please see JAXA-QTS-2180”

Details of Our Temperature Sensor

EPPL
Parts

H-2A project
parts



【Application】

Launch vehicle including AGE

- H-2
- H-2A/B

Space vehicle

- HTV H-2 Transfer Vehicle

Satellite

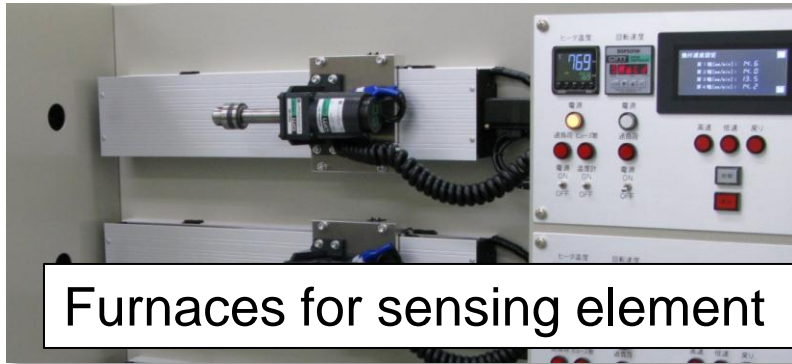
- ALOS
- GOSAT
- MTSAT
- ETS
- ADEOS
- AVNIR
- COMETS
- Terra/ASTER
- AMSR
- DRTS
- GCOM

Contents

- Product Overview
- History of our Sensor
- Method of Temperature Measurements
- Details of our Temperature Sensor
- Quality assurance, Manufacturing and Supply

Quality assurance and Manufacturing

To keep high quality of the product, almost every inspection and production process is done in the clean room.



Furnaces for sensing element



Winding Instrument



Micro-focus X-ray inspection

【Quality Conformance Inspection】

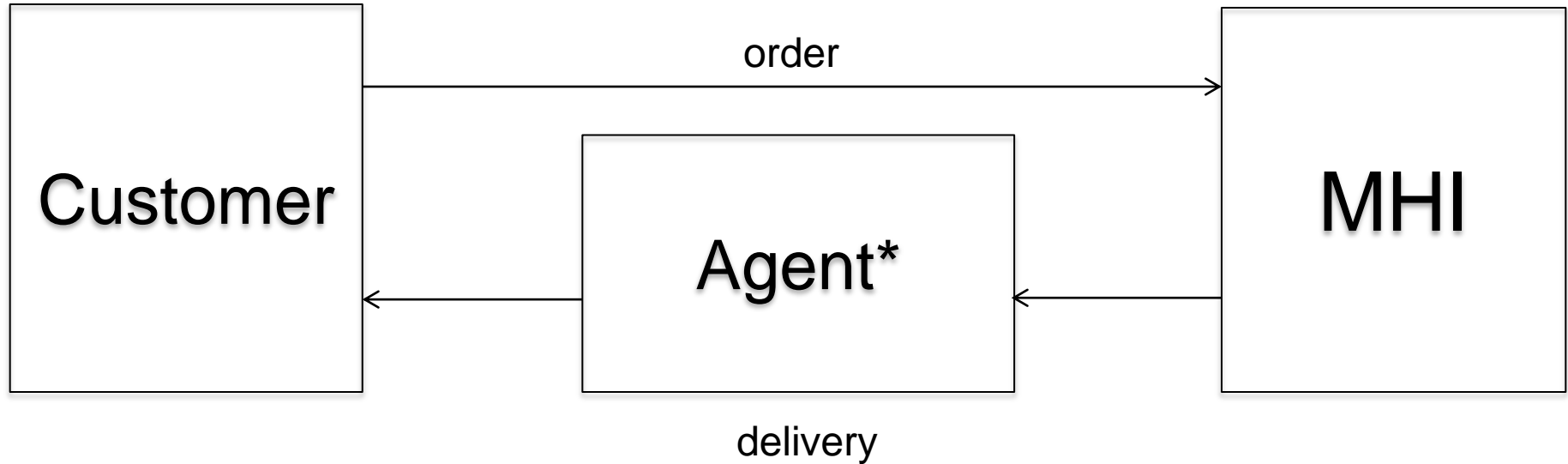
All the products are subjected to quality conformance inspection in accordance with JAXA-QTS-2180. Items of inspection are listed below.

- Externals, dimensions, marking and others
- Proof pressure
- Leakage
- Insulation resistance
- Dielectric withstanding voltage
- Interchangeability
- Humidity resistance
- Cleanliness

【Special process inspection】

After special processes such as welding, brazing and coating, condition of the products is strictly checked by member of the quality assurance department.

Supply



*Only shipping and custom-house business

■ Contact

MITSUBISHI HEAVY INDUSTRIES, LTD.

Space Systems Division, Aerospace systems

Phone: +81-3-6716-3111

URL: www.mhi.co.jp/en/inquiry/inquiry_space.html

Thank for your attention!