

OPTICAL TEMPERATURE TRANSMITTER

The Model FUK 3/FUL 3/FUM 1 is Optical Temperature Transmitter for thermocouple or platinum resistance bulb used for measuring the temperature of different fluids. The transmission unit incorporates a microprocessor that carries out digital processing of signals for ensuring a high accuracy and an intelligent operation.

A fiber optical cable used for the signal transmission line forms an optical field instrumentation system together with an optical star coupler and a master station.



FUK
FUL



FUM

MODEL TYPE CONFIGURATION

- 1) Thermocouple temperature transmitter (integrated type), Model type: FUK
- 2) Resistance bulb temperature transmitter (integrated type), Model type: FUL
- 3) Temperature transmitter (separate type), Model type: FUM

FEATURES

1. Resistive to noise and lightning

Optical signal ensures a reliable signal transmission, because it is not be affected by external noise and inductive lightning. Use of a nonmetallic optical (fiber) cable prevents propagation of inductive lightning through the cable, so a signal transmission immune to lightning can be realized.

2. Reliability due to redundant configuration

Host system can be duplicated by using two optical cable trunk lines (between an optical star coupler and host system). This enhances reliability of users' systems.

3. Intrinsic safety type explosion-proof

Each equipment with a built-in battery can be constructed so as to be an intrinsic safety type individually (intrinsic safety type barrier unnecessary).

(2) Separate type (FUM)

	Measuring range	Measuring span	
		Minimum	Maximum
J thermocouple	-200 to +750°C	100°C	750°C
E thermocouple	-200 to +800°C	100°C	800°C
K thermocouple	-200 to +1200°C	150°C	1200°C
R thermocouple	0 to +1600°C	200°C	1600°C
T thermocouple	-200 to +350°C	50°C	350°C
Resistance bulb Pt100	-200 to +600°C	80°C	600°C

Operating pressure:

Flange type ... Rated pressure of flange
Screw-in type ... 4 MPa or less

Output:

Optical digital signal

Burnout:

If sensor is burnt out, last output is held, and alarm is delivered (detecting unit failure)

Self-diagnosis: Displayed on indication unit (option) and transmitted to master station.

Diagnosis item	Host system	Indication unit
Measuring range abnormal	○	○
Detecting unit failure	○	○
Amplifier abnormal	○	○
Battery voltage	○	—
Battery voltage low alarm	○	○

SPECIFICATIONS

Functional specifications

Fluids measured: Liquid, gas or steam

Measuring range, measuring span:

(1) Integrated type (FUK, FUL)

	Measuring range	Measuring span	
		Minimum	Maximum
J thermocouple	-200 to +400°C	50°C	400°C
E thermocouple	-200 to +400°C	50°C	400°C
K thermocouple	-200 to +400°C	50°C	400°C
Resistance bulb Pt100	-200 to +400°C	50°C	400°C

Remote Control Function:

(Items readable and setting from hand-held communicator)

Item	Reading	Setting	Description
Maximum range	○	—	Maximum measuring range of equipment
Measuring range	○	○	Actual measuring range
Real scale indication	○	○	Indication in industrial value
Battery voltage	○	—	Battery voltage of equipment
Error indication	○	—	Errors of detection unit and amplifier
Measured value	○	—	Measured data
Adjustment	○	○	Zero and span adjustment

Note: For operation of the "3" type transmitter ("3" at the 8th digit of product code), a hand-held communicator is required to have a version 1.6 or higher, but a communicator before version 1.6 can be operated with memory data updated.
(Refer to the instruction manual of temperature transmitter.)

- Output signal:** Optical digital signal
- Power supply:** Built-in lithium battery (expected life: about 4 years)
- Optical cable:** Code set type, silica fiber ... core/clad diameter 100/140 μm
- Optical connector:** FC connector
- Transmission distance:** 1.5 km max. (when transmission loss of optical cable is 4 dB/km)
- Zero point shift:** Minimum temperature to 80% of maximum temperature of measuring range
- Explosion-proof:** Intrinsic safety type, JIS ib IIC T3
- Ambient temperature:**
 - 30 to +70°C
 - 10 to +60°C for intrinsic safety explosion-proof type
 - 20 to +70°C when provided with indicator
- Storage temperature:** -40 to +80°C

Performance specifications

- 1. Detecting unit (for FUK, FUL)**
- Accuracy rating:** Thermocouple ... IEC 584, class 2
Resistance bulb ... IEC751, class B
- Response time (time constant):**
 - For protective pipe Ø4.8 mm ... About 8 sec
 - For protective pipe Ø12 mm ... About 70 sec

2. Transmission unit

Accuracy rating

Model type	Sensor type	Temperature range	Accuracy rating
FUK1 (integrated type)	J thermocouple	-140 to +400°C	±0.6°C
FUM□A (separate type)		Less than -140°C *	±1°C
FUM□B (separate type)	J thermocouple	-100 to +750°C	±1.1°C
		Less than -100°C *	±1.9°C
FUK2 (integrated type)	E thermocouple	-200 to +400°C	±0.6°C
FUM□C (separate type)			
FUM□D (separate type)	E thermocouple	-80 to +800°C	±1.2°C
		Less than -80°C *	±2°C
FUK3 (integrated type)	K thermocouple	-150 to +400°C	±0.6°C
FUM□E (separate type)		Less than -150°C *	±1°C
FUM□F (separate type)	K thermocouple	0 to +1200°C	±1.8°C
		Less than 0°C *	±3°C
FUM□G (separate type)	R thermocouple	0 to +1600°C	±4°C
FUM□H (separate type)	T thermocouple	-200 to +350°C	±0.8°C
FUL1 (integrated type)	Pt100	-200 to +400°C	±0.6°C
FUM□L (separate type)			
FUM□K (separate type)		-200 to +600°C	±0.9°C
FUM□N (separate type)	JPt100	-200 to +400°C	±0.6°C
FUM□P (separate type)	JPt100	-200 to +500°C	±0.7°C

Note 1: Accuracy is for when segment correction is made.
Note 2: Reference junction compensation error is not included.

- Reference junction compensation accuracy:** ±1°C (for thermocouple)
- Ambient temperature effect:** (shift between -30 to +70°C) ±0.5% of maximum measurement temperature or, if temperature range above is marked "*", ±1%
- Allowable wiring resistance:** (For separate type)
 - Thermocouple ... 100Ω or less.
 - Resistance bulb ... 10Ω or less.

Physical specifications

- Environmental protection:** Meets JIS C0920, immersion-proof (equivalent to IEC IP67 or NEMA 6/6P)
- Optical cable connection:** G1/2
- Mounting method:**
 - (1) FUK, FUL: Screw-in or flange mounting ... As specified by code symbol
 - (2) Separate type (FUM): Mounted on 50A (2B) pipe with U-bolt or on a wall
- Finish:** Epoxy-polyurethane double coat, silver (blue for amplifier case cover).
- Mass:**
 - (1) FUK, FUL ... 3 to 5 kg.
Varies with sensor unit length.
 - (2) Separate type (FUM) ... About 2.4 kg
- Insertion length:** (FUK, FUL sensor unit length) 100 to 2000 mm ... See Code symbols
- Minimum bend radius:** (Allowable bend of FUK or FUL sensor unit) 14.4 mm ... Sheath type (Ø4.8 mm) only
- External dimensions:** See OUTLINE DIAGRAM.
- Material:** (FUK, FUL sensor unit protective pipe) SUS304 or SUS316 ... As specified by code symbol

Optional specifications

Indication unit: 5-digit LCD indication, % or real scale indication
Operating temperature range: -20 to +70°C

SCOPE OF DELIVERY

Instrument body and pipe fixture (for separate type)

Relation between velocity of fluid measured and insertion length

When measuring a temperature upon insertion in the fluid piping, the temperature detector is subjected to a stress by fluid flow. So, the mechanical strength of a protective pipe to put in must be taken into account.

Study the insertion length for a thermometer to use referring to the relation between velocity and insertion length in Fig. 1.

If a sheath type is inserted in fluid, provide a protective pipe separately.

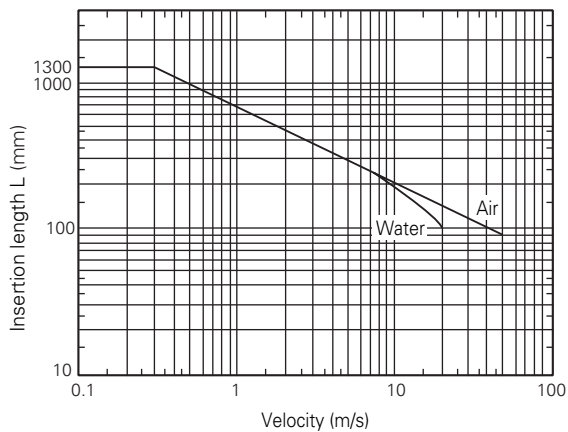
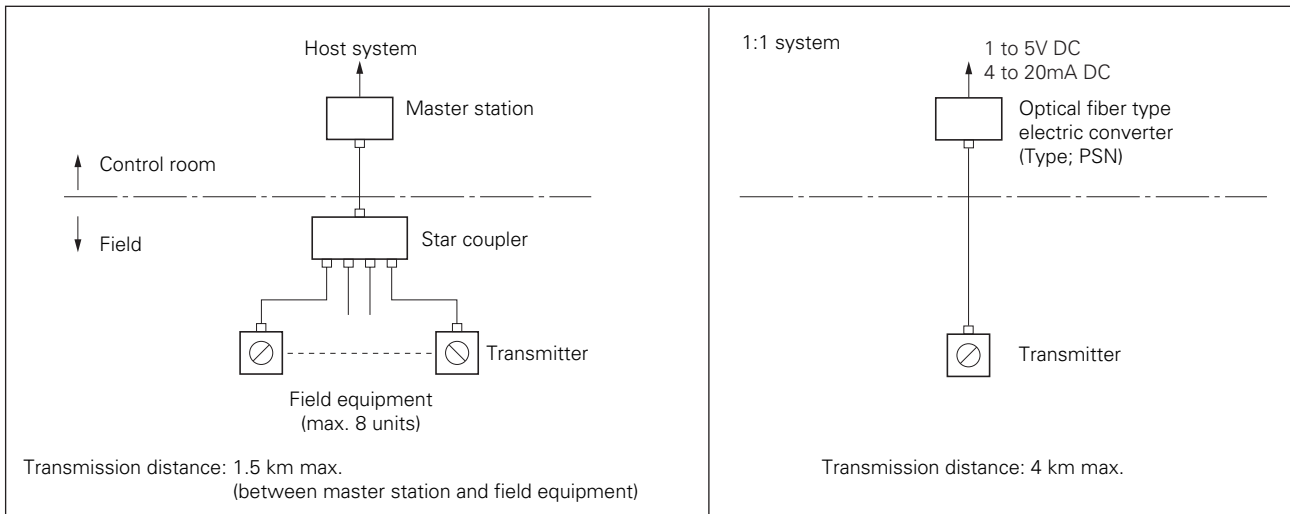


Fig. 1 Relation between velocity and insertion length (for Ø12 mm protective pipe)

SYSTEM BLOCK DIAGRAM



CODE SYMBOLS

(1) Thermocouple temperature transmitter

1	2	3	4	5	6	7	8	9	10	11	12	13	Description
F	U	K					3						
1													Measuring range (4th digit)
2													J thermocouple -200 to +400°C
3													E thermocouple -200 to +400°C
													K thermocouple -200 to +400°C
A													Protective pipe shape (mm) (5th digit)
B													Ø12
													Ø4.8 (sheath type)
S													Protective pipe material (6th digit)
W													SUS304 (cannot be specified when 5th digit is B)
													SUS316
A													Indicator (7th digit)
L													Not provided
P													Digital, % indication
													Digital, real scale indication
													Mounting dimension (9th digit)
0													Flange JIS 10K-25ARF
1													Flange JIS 20K-25ARF
2													Flange JIS 30K-25ARF
3													Flange JIS 63K-25ARF
4													Screw-in G3/4B
5													Screw-in R3/4
6													Screw-in 3/4-14NPT
7													Flange ANSI 150LB, 1B
8													Flange ANSI 300LB, 1B
9													Flange ANSI 600LB, 1B
													Cable lead-in port (10th digit)
S													G1/2
T													1/2-14NPT
													Explosion-proof (11th digit)
0													Non-explosion proof
1													Intrinsic safety, JIS
													Insertion length (mm) (12th and 13th digits)
0	1												100
0	2												200
0	3												300
0	4												400
0	5												500
0	6												600
0	7												700
0	8												800
0	9												900
1	0												1000
1	1												1100
1	2												1200
1	3												1300
1	4												1400
1	5												1500
1	6												1600
1	7												1700
1	8												1800
1	9												1900
2	0												2000

} Cannot be specified when 5th digit is A

CODE SYMBOLS

(2) Resistance bulb temperature transmitter

1	2	3	4	5	6	7	8	9	10	11	12	13	Description
F	U	L					3						
			1										Measuring range (4th digit) 3 wire system Pt100 (1997) -200 to +400°C
				A									Protective pipe shape (mm) (5th digit) Ø12
				B									Ø4.8 (sheath type)
					S								Protective pipe material (6th digit) SUS304 (cannot be specified when 5th digit is B)
					W								SUS316
						A							Indicator (7th digit) Not provided
						L							Digital, % indication
						P							Digital, real scale indication
													Mounting dimension (9th digit)
								0					Flange JIS 10K-25ARF
								1					Flange JIS 20K-25ARF
								2					Flange JIS 30K-25ARF
								3					Flange JIS 63K-25ARF
								4					Screw-in G3/4B
								5					Screw-in R3/4
								6					Screw-in 3/4-14NPT
								7					Flange ANSI 150LB, 1B
								8					Flange ANSI 300LB, 1B
								9					Flange ANSI 600LB, 1B
													Cable lead-in port (10th digit)
									S				G1/2
									T				1/2-14NPT
													Explosion-proof (11th digit)
										0			Non-explosion proof
										1			Intrinsic safety, JIS
													Insertion length (mm) (12th and 13th digits)
										0	1		100
										0	2		200
										0	3		300
										0	4		400
										0	5		500
										0	6		600
										0	7		700
										0	8		800
										0	9		900
										1	0		1000
										1	1		1100
										1	2		1200
										1	3		1300
										1	4		1400
										1	5		1500
										1	6		1600
										1	7		1700
										1	8		1800
										1	9		1900
										2	0		2000

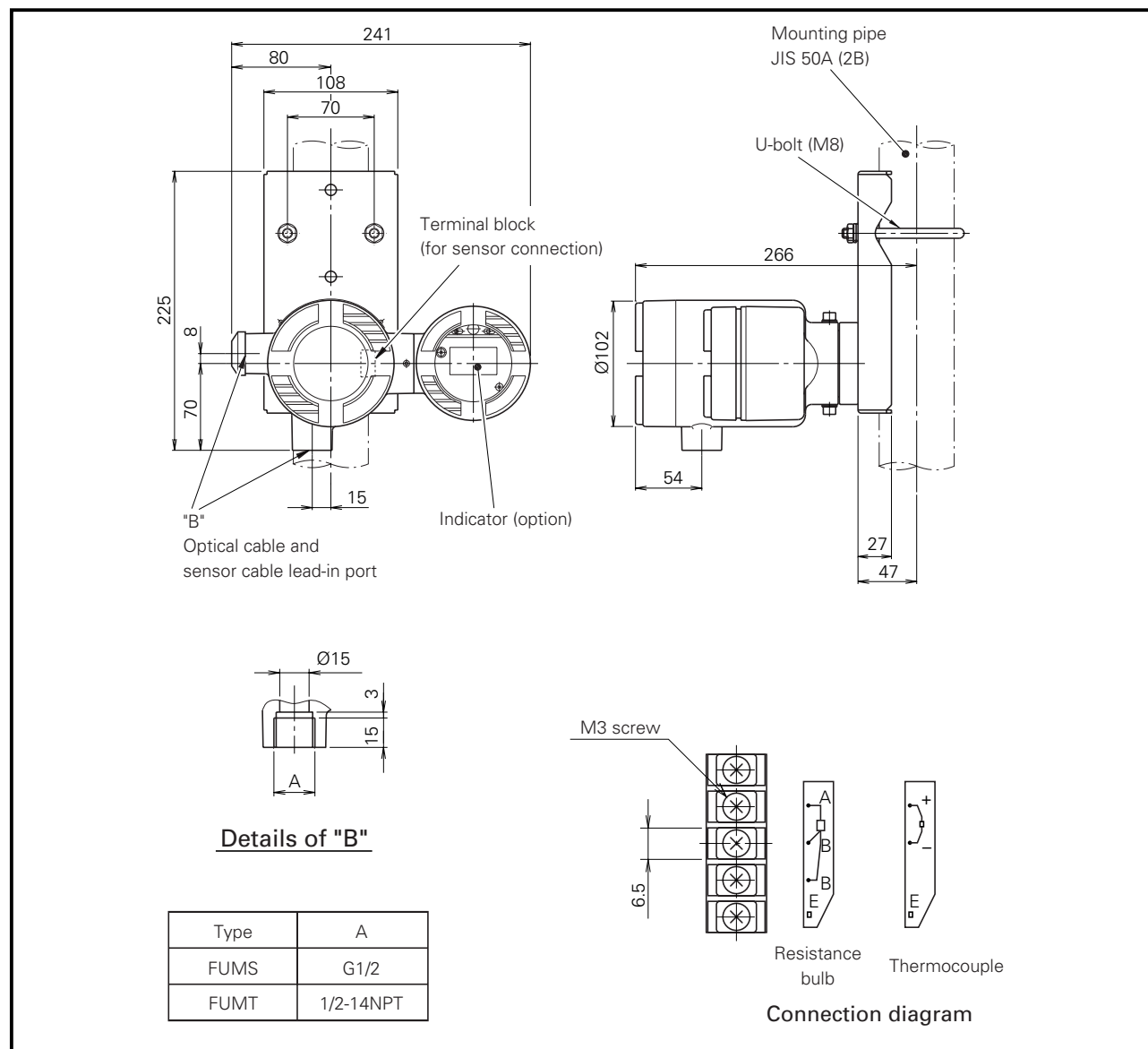
Cannot be specified when 5th digit is A

(3) Temperature transmitter (separate type)

1	2	3	4	5	6	7	8	Description
F	U	M					1	
								Cable lead-in port (4th digit)
							S	G1/2
							T	1/2-14NPT
								Sensor type, measuring range (5th digit)
						A		J thermocouple -200 to +400°C
						B		J thermocouple -200 to +750°C
						C		E thermocouple -200 to +400°C
						D		E thermocouple -200 to +800°C
						E		K thermocouple -200 to +400°C
						F		K thermocouple -200 to +1200°C
						G		R thermocouple 0 to +1600°C
						H		T thermocouple -200 to +350°C
						J		3 wire system Pt100 (1989) -200 to +400°C
						K		3 wire system Pt100 (1989) -200 to +600°C
						L		3 wire system Pt100 (1997) -200 to +400°C
						M		3 wire system Pt100 (1997) -200 to +500°C
						N		3 wire system JPt100 -200 to +400°C
						P		3 wire system JPt100 -200 to +500°C
								Explosion-proof (6th digit)
						A		For general application (Non-explosion proof)
						G		Intrinsic safety, JIS
								Indicator (7th digit)
						A		Not provided
						L		Digital, % indication
						P		Digital, real scale indication

OUTLINE DIAGRAM (Unit : mm)

2) Temperature transmitter (separate type)



ORDERING INFORMATION

1. Model type
2. Measuring range
3. Indication scale for real scale specification
4. Others

⚠ Caution on Safety

*Before using this product, be sure to read its instruction manual in advance.

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