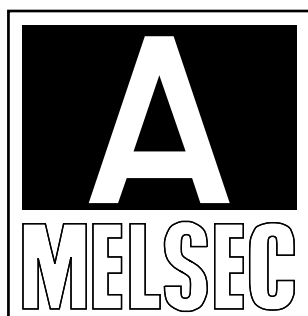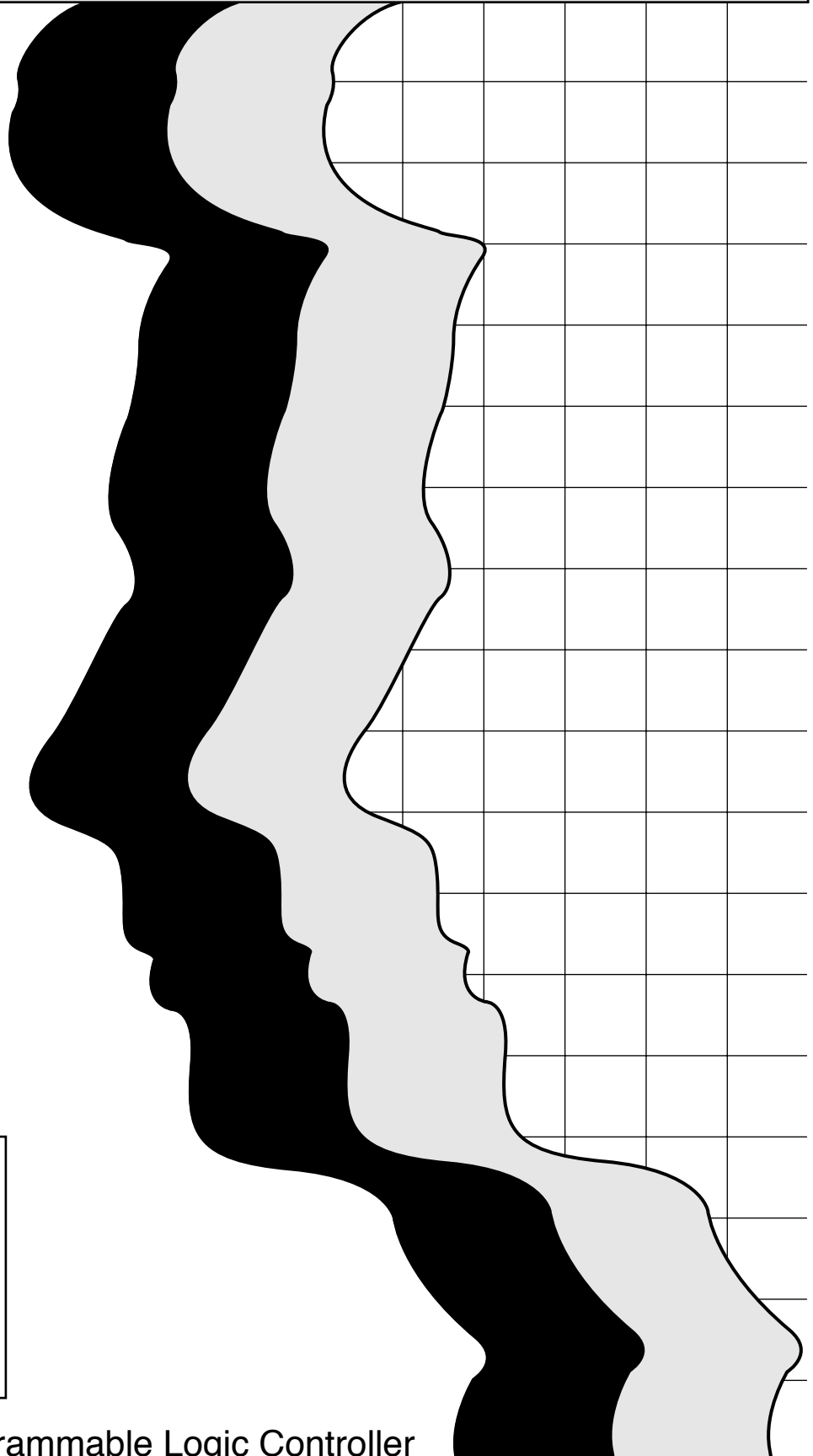# MITSUBISHI

Supersonic Linear Scale Module Type A64BTL

User's Manual

A
MELSEC

Mitsubishi Programmable Logic Controller

● Precautions Regarding Safety ●

When using your product, please make sure that you have read this manual, as well as any related manuals introduced in this manual, and that careful attention is paid to safety and correct handling of the equipment.

Only safety precautions which apply to this specific product have been noted here. For precautions pertaining to the PC system, please refer to the User's Manual provided with the CPU unit.

Safety precautions noted in this section are distinguished by either a "Danger" or a "Caution" mark, depending on the degree of danger involved.

◇ **DANGER**	**Erroneous handling could result in hazardous conditions and could cause severe or fatal injury.**
⚠ **CAUTION**	**Erroneous handling could result in hazardous conditions and could cause minor or moderately serious injury, or could result in damage to physical property.**

Items marked with ⚠ CAUTION could also cause significant damage or injury, depending on the circumstances. Precautions marked by either of these signs should be carefully observed and the contents considered particularly important.

This manual should be stored carefully in a place where it is easily accessible when necessary, and should always be passed on to the end user if the equipment is transferred to another user.

[Precautions Regarding Design]

◇ DANGER
● A safety circuit should be installed on the exterior of the PC to ensure safe operation of the entire system even if there is a problem with the external power supply, or if the PC main unit breaks down.   Erroneous output or operation can result in accidents.   (1) The circuit configuration on the exterior of the PC should include interlock circuits such as an emergency stop circuit, upper and lower limit position detectors, and other circuits to protect the machinery from damage.   (2) A breakdown in an output unit relay, transistor, or other component could possibly cause the output to remain on or off inappropriately. The circuit configuration should allow external monitoring of output signals where serious accidents could possibly occur.

[Precautions When Disposing of the Equipment]

⚠ CAUTION
● When disposing of this product, it should be handled through industrial product disposal channels.

Revisions

* The manual number is noted at the lower left of the back cover.

Print Date	*Manual Number	Revision
Mar. 1996	IB (NA)-66639-A	First printing

May 1996	IB (NA)-66639-B	Addition:
		    Chapter 1, Section 2.1.1, 2.1.2, 2.1.3
		Correction:
		    Section 2.3.1, 3.2, 3.3.2(6), 3.4.2(1), 3.4.2(2), 4.3, Fig. 4.2, Section 5.2,
		    Appendix 1, Appendix 2

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		    Section 1.1, WARRANTY
		Correction:
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		    Section 3.3.2, 3.4.2 ,4.2 ,4.3, 4.4.2 ,5.1,5.2 ,6.1,
		    Appendix 1, Appendix 1.1, Appendix 1.2

Japanese Manual Version IB-68611-B

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Introduction

Thank you for purchasing the Mitsubishi MELSEC-A Series General-Purpose PC.

Before using your product, please read this manual carefully and make sure you understand the functions and performance of the A Series sequencer, and that you use it carefully and correctly.

Should the product be transferred to another user, please make sure this manual is passed along to the end user together with the equipment.

Contents

5. Programming

6. Troubleshooting

Appendices

1. Overview

This manual describes the specifications, handling, and programming of the A64BTL Supersonic Linear Scale (hereafter referred to as the A64BTL) used in conjunction with the CPU unit of the MELSEC-A series.

The A64BTL is a linear position sensor which detects the mechanical position of the machine to be controlled by connecting to one micropulse linear scale, compares the detected position which a position specified in advance, and outputs ON/OFF signals which change in response to conventional limit switches.

The A64BTL uses an absolute no-contact type of micropulse linear scale BTL (made by the German firm Balluff; hereafter referred to as the linear scale) as the linear position detector.

The micropulse linear scale BTL is a linear scale which utilizes supersonic waves produced by the magnetostrictive effect. Because no contact is involved in measurements, there is no deterioration of precision due to wear.

The tightly sealed construction enables the equipment to be used under adverse environmental conditions and allows incorporation into hydraulic cylinders (rod types).

The A64BTL is provided with a limit switch detection function, enabling it to be used for the automatic control employed with hydraulic cylinder position detection, stroke detection on press machines, hydraulic gauge sensors on cleaning equipment, and in many other position detection applications.

1.1 Features

The A64BTL offers the following features.

(1) It can be connected to a linear scale for use under adverse environmental conditions.

Since no contact is involved, there is no deterioration of precision due to wear, making this instrument ideal in situations where frequent use is called for. The tightly sealed construction enables use under adverse environmental conditions, as well as allowing it to be incorporated into equipment used underwater or in oil. The A64BTL can be connected to linear scales which can be used in situations like those described above.

(2) Comparison outputs can be produced at four points for each channel.

The set values and measured values can be compared and the results output without affecting the PC scan time, enabling real-time control.

(3) Four linear scales can be connected.

Four linear scale interface channels are provided, enabling four linear scales to be connected to one A64BTL.

Micropulse linear scale BTL

The "INIT signal" from the A64BTL passes an "INIT pulse current" through the wave guide in the scale.

This pulse current and the magnetic field produced by the magnet of the pointer at a measurement point (current position) on the scale generates "torsion waves" (magnetostrictive effect) in the wave guide. These "torsion waves" propagate on the wave guide at supersonic speed. Among the "torsion waves", the component moving away (toward the damping zone) is absorbed in the damping section, and the "torsion wave" moving toward the output side is converted into an electrical signal by the detection coil. The linear scale sends the "START signal" to the A64BTL when it gives the "INIT pulse current" to the wave guide, and sends the "STOP signal" when it detects the "torsion wave". The A64BTL measures a position from the time between the "START signal" and "STOP signal", converts the resultant value into the corresponding output value, and outputs it to the outside.

2. System Configuration

2.1 Overall Configuration

The illustration below shows the overall configuration of the A series in which the A64BTL is installed.

2.1.1 When Used with a Building-Block CPU
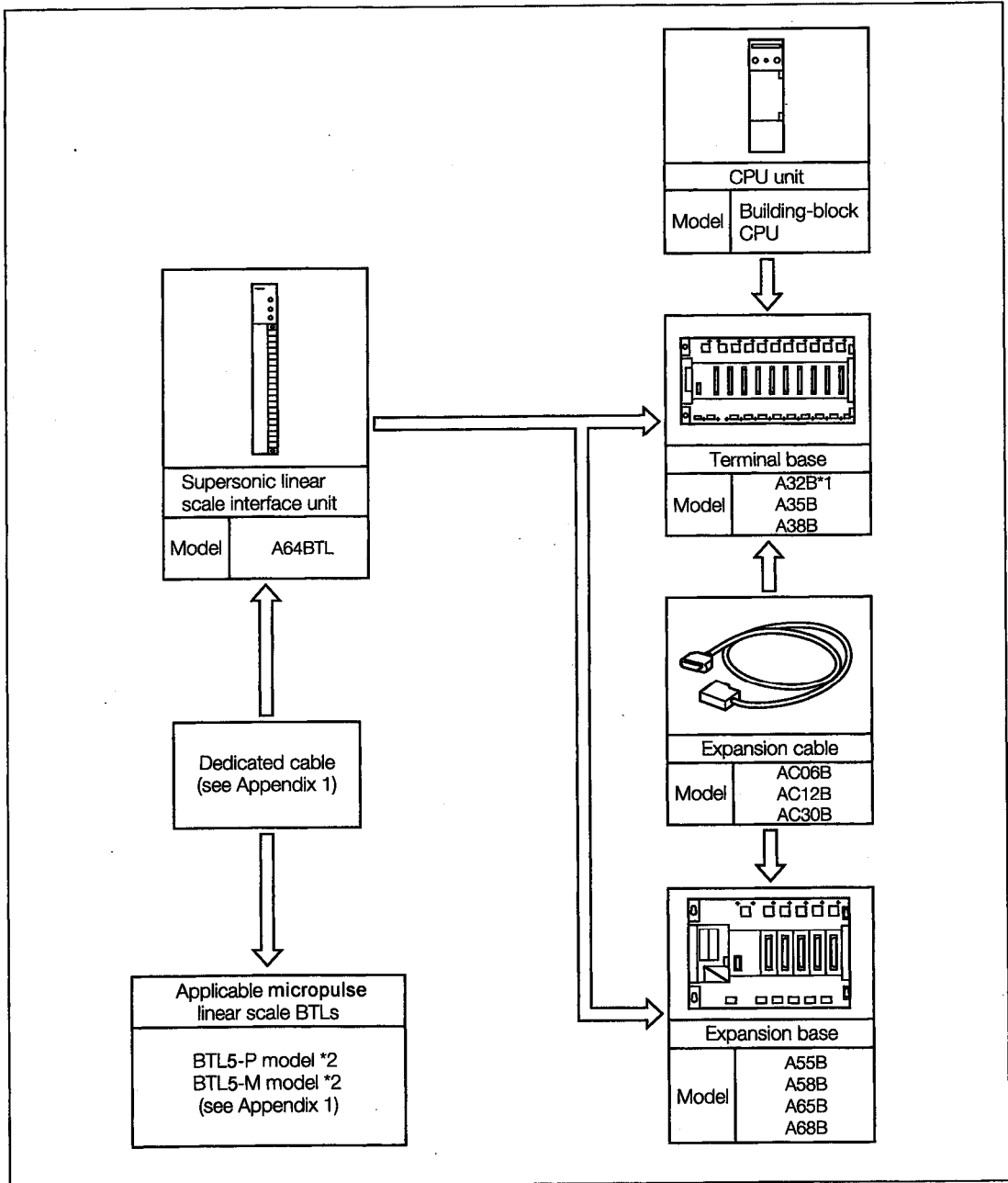
Fig. 2.1 Overall configuration using building-block CPU

NOTE

① *1..........An expansion base cannot be connected to the A32B.

② *2..........External supply power for linear scale is required.

2.1.2   When Used with a Compact CPU
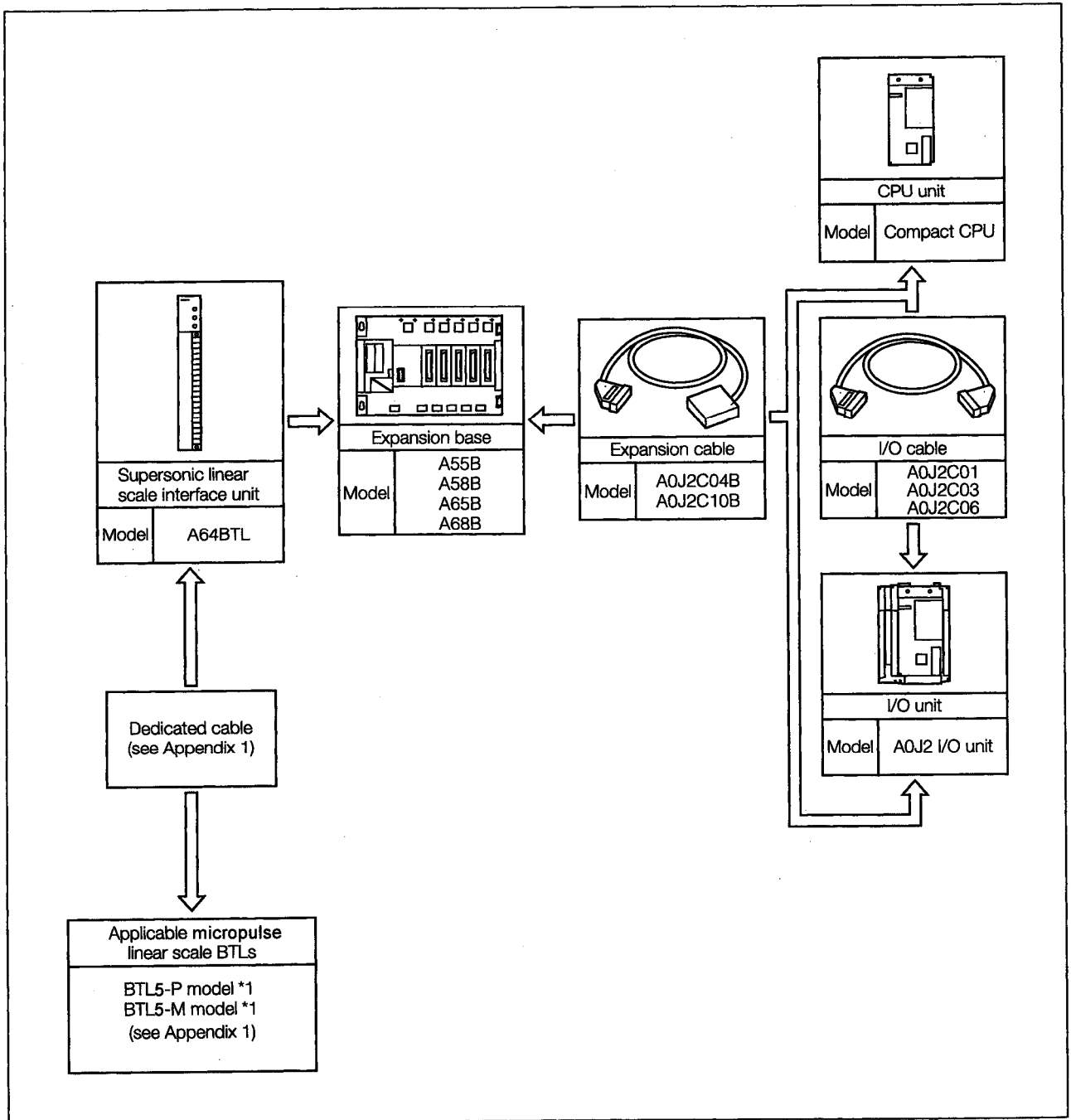
Fig. 2.2 Overall configuration using compact CPU

NOTE

① *1..........External supply power for linear scale is required.

2.1.3   When Used with a Small Building-Block CPU
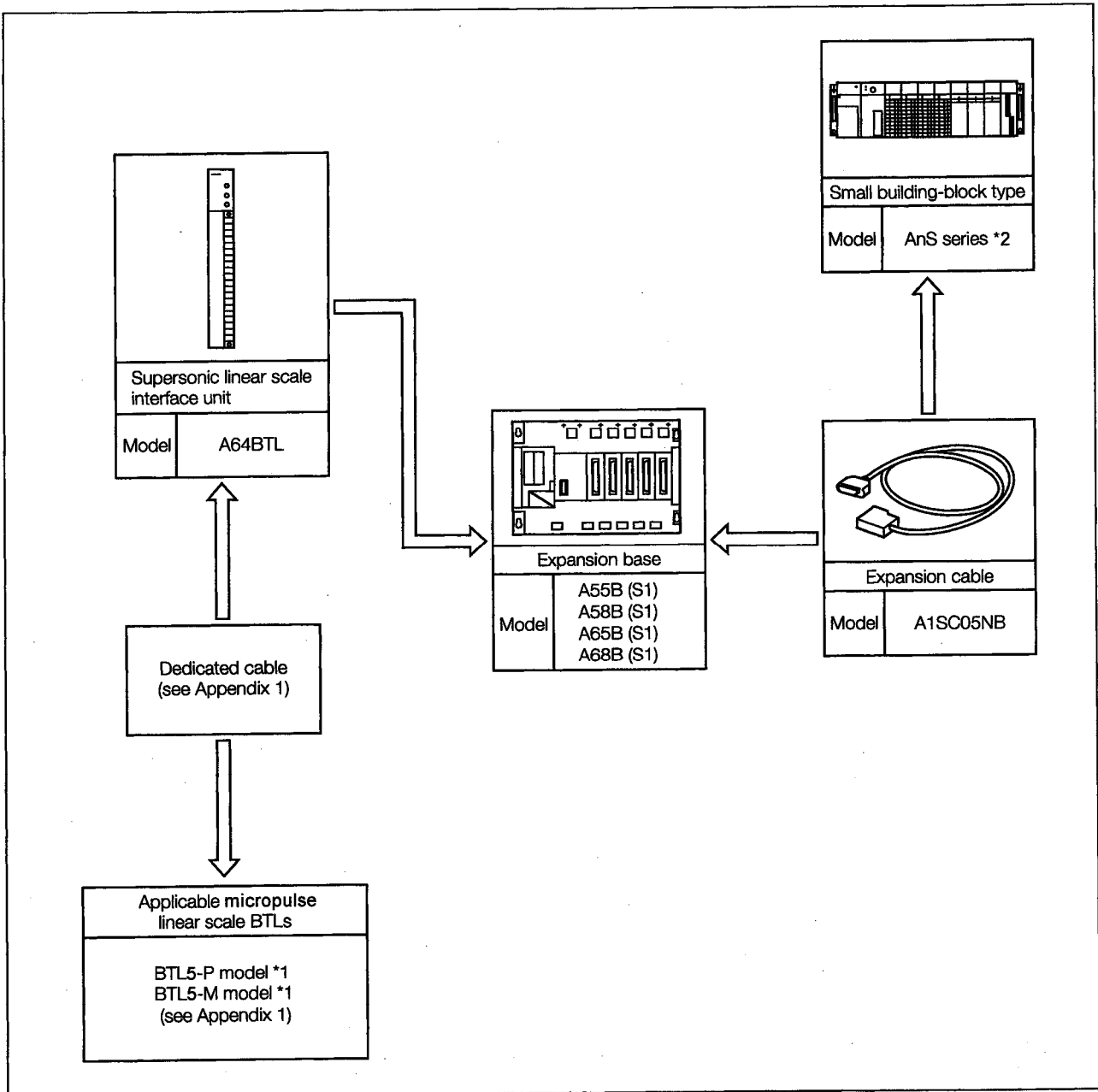
Fig. 2.3 Overall configuration using small building-block CPU

NOTE

① *1..........External supply power for linear scale is required.

② *2..........Q (A mode) series cannot be used.

2.2 Applicable Systems

The A64BTL can be used with systems that have the contents listed below. Please be aware that it cannot be used with any other systems.

(1) The A64BTL can be used with systems that have the following CPUs.

Applicable CPU units		
A0J2CPU	A1 (N) CPU	A2UCPU
A0J2HCPU	A2 (N) CPU	A2UCPU-S1
A1SCPU, A1SHCPU	A2 (N) CPU-S1	A3UCPU
A1SJCPU, A1SJHCPU	A3 (N) CPU	A4UCPU
A2SCPU, A2SHCPU	A2ACPU	Q2ACPU
A2ASCPU, A2USHCPU-S1	A2ACPU-S1	Q2ACPU-S1
A2ASCPU-S1, A2USHCPU-S1	Q2ASCPU, Q2ASCPU-S1	Q2ASHCPU, Q2ASHCPU-S1
A3ACPU	Q3ACPU	Q4ACPU

The above CPUs can be used also when a data link system is included.

(2) The A64BTL can be installed in any I/O slot in the base unit except those listed below.

  (a) If installed in an expansion base unit that does not have a power supply unit (such as the A55B-S1 or A58B-S1), there may be times when the power supply is not sufficient to run the A64BTL. The user should avoid installing the A64BTL in this type of unit.

    If it is installed in such a unit, make sure the power supply unit selected for the terminal base has a sufficient current capacity, and that the voltage of the expansion cable is adequate.

    (For details, please refer to the User's Manual for the CPU unit.)

  (b) If the A3CPU (P21/R21) is being used, the A64BTL cannot be installed in the last slot in the 7th expansion stage.

Applicable Models of Remote I/O Stations	
AJ72P25/R25	AJ71AT25B
AJ72LP25/BR15	AJ72QLP25/BR15

POINT

The A64BTL cannot be installed in the A0J2P25/R25 (remote I/O station).

2.3   Precautions Concerning the System Configuration

2.3.1   Precautions Concerning the External Power Supply

In order to use the A64BTL, an external 24 VDC power supply is required.

2.3.2   Correcting Individual Error in the Linear Scale

Each linear scale has the correction value for the actual supersonic speed stamped on the scale. Positional measurement can be carried out more accurately if this numeric value is entered in the buffer memory.

(For detailed information, please see section 3.4.2 (4), "An Explanation of the Storage Area in the Buffer Memory".)

3. Specifications

3.1   General Specifications

Table 3.1 shows the general specifications for the A64BTL.

Table 3.1 General Specifications

Item	Specifications				
Ambient usage temperature	0 to 55 °C				
Ambient storage temperature	–20 to 75 °C				
Ambient usage humidity	10 to 90% room humidity, with no condensation				
Ambient storage humidity	10 to 90% room humidity, with no condensation				
Vibration withstand resistance	Conforms to JIS B 3502 and IEC 61131-2	With intermittent vibration			A No. of sweeps
		Frequency	Acceleration	Amplitude	10 times each in XYZ directions (80 min.)
		10 to 57 Hz	——	0.075 mm	
		57 to 150 Hz	9.8 m/s²	——	
		With continuous vibration			
		10 to 57 Hz	——	0.035 mm	
		57 to 150 Hz	4.9 m/s²	——	
Impact withstand resistance	Conforms to JIS B 3502 and IEC 61131-2 (147 m/s², 3 times each in XYZ directions)				
Usage atmosphere	No corrosive gases				
Usage altitude	2,000 m max.				
Installation location	On control panel				
Overvoltage category *1	II max.				
Contamination *2	2 max.				

NOTE

*1. Indicates the section of wiring between the public sector and the in-house wiring to which the equipment is assumed to be connected.

Category II applies to equipment to which power is supplied from fixed facilities. The surge withstand value for equipment with a rated value of up to 300 V is 2,500 V.

*2. Index indicating the degree to which conductive materials are generated in the usage environment by that equipment. At contamination level 2, only non-conductive contaminants are generated, but conductivity is likely to occur temporarily under freezing conditions.

⚠ **CAUTION**

- The sequencer should be used under the general specifications noted in the manual. Using it in an environment other than the general specifications could result in electrical shock, fire, malfunctioning, and/or damage to the product.

3.2   Performance Specifications

Table 3.2 shows the performance specifications for the A64BTL.

Table 3.2 Performance specifications

Item			Specifications
No. of I/O points allocated			32 points (I/O assignments: 32 special function unit points)
No. of channels			4 channels
Position informa- tion	Measurement range		0.000 to 3550.000 mm (*1)
	Resolution (*3)		0.025
	Sampling timing		2ms
	Accuracy (*4)	Normal	±2 × Resolution mm
		Noise weight	+5 × Resolution –2 × Resolution mm
External output	Comparison range		24-bit binary (to 3rd decimal place × 1000 times)
	Comparison results		Contact point operation: Output when dog ON address ≤ counter value < dog OFF address
	No. of comparison output points		(4 points × 1 dog) / 1 channel
	Comparison output		Transistor output (source type) 12/24 VDC, 0.1 A/1 point, 2 A/1 common, fuse: 3.2 A/1 common (Response time) OFF → ON: 4.8 ms max. (*2) ON → OFF: 4.8 ms max. (resistance load)
Type of micropulse linear scale BTL which can be connected			P and M types (switchable using setting pins) — See Section 4.3, ⑦
Noise withstand volume			Noise voltage 1500 Vp-p
Voltage withstand resistance			500 VAC grounding to all DC external terminals for 1 minute
Connection terminals			38-point terminal base
Applicable cable size			0.75 ~ 2 mm² (applicable tightening torque: 64N-cm)
Applicable crimp terminals			V1. 25-3, V1. 25-YS3A, V2-S3, V2-YS3A
Internal current consumption (DC5V)			1.05 A
Weight			0.5 kg
External dimensions (mm)			250 (H) × 37.5 (W) × 131 (D)

(*1) The A64BTL can be set so that the position information output for any position within the linear scale measurement range is 0.

(*2) This is the time between when the linear scale pointer arrives at the specified external output position and the external output is output.

(*3) The resolution is formulated and it is changed by actual supersonic speed correction value as follows.

$$\text{Resolution} = 0.025 \times \frac{\text{actual supersonic speed correction value}}{2850} \text{ (mm)}$$

(*4) The accuracy described in this section is the accuracy only for A64BTL.

POINT

Noise withstand volume

The rated noise voltage is applied by a noise simulator, with a noise width of 1 μs and a noise frequency of 25 to 60 Hz.

3.3 Signals Input to and Output from the PC CPU

3.3.1 Table of Input and Output Signals

The signals input to and output from the PC CPU of the A64BTL are as shown below.

(1) The A64BTL uses 32 input points and 32 output points for transmitting data to and from the PC CPU.

(2) The input and output signals have the following meaning:

    (a) Device X: Input signals from the A64BTL to the PC CPU

    (b) Device Y: Output signals from the PC CPU to the A64BTL

(3) Table 3.3 shows the signals when the A64BTL has been installed in I/O Slot 0 of the terminal base unit.

Table 3.3 I/O signals

Signal Direction: A64BTL → CPU		Signal Direction: CPU → A64BTL	
Device No.	Signal Name	Device No.	Signal Name
X00	WDT error flag	Y00	Can't be used
X01	External output 0-3 enabled flag	⋮	
X02	External output 4-7 enabled flag		
X03	External output 8-B enabled flag		
X04	External output C-F enabled flag	Y0C	
X05	Error flag	Y0D	Interlock signals for RFRP and RTOP instructions when A64BTL is used for remote I/O station
X06	CH. 1 disconnected wiring detection flag	⋮	
X07	CH. 2 disconnected wiring detection flag	Y0F	
X08	CH. 3 disconnected wiring detection flag	Y10	Forced output mode instruction
X09	CH. 4 disconnected wiring detection flag	Y11	CH. 1 external output enabled
X0A	Can't be used	Y12	CH. 2 external output enabled
⋮		Y13	CH. 3 external output enabled
		Y14	CH. 4 external output enabled
		Y15	Error reset
		Y16	Open
		Y17	CH. 1 zero point correction setting
		Y18	CH. 2 zero point correction setting
		Y19	CH. 3 zero point correction setting
X1C		Y1A	CH. 4 zero point correction setting
X1D	Interlock signals for RFRP and RTOP instructions when A64BTL is used for remote I/O station	Y1B	Can't be used
⋮		⋮	
X1F		Y1F	

IMPORTANT

Y00 to Y0C and Y1B to Y1F are used for the system, and are not available to the user.

If they are used (turned ON/OFF) by the sequence program, the function of the A64BTL cannot be guaranteed.

X00 to X1F and Y00 to Y1F of the same numbers cannot be used as internal relays.

3.3.2   Functions of Input and Output Signals

This sections explains the ON/OFF timing. conditions, and other information pertaining to the signals input to and output from the sequencer CPU.

(1) WDT (watchdog timer) error flag (X00)

This is turned ON if a watchdog timer error is determined to have occurred by the A64BTL self-diagnosis function. If this happens, all output from the A64BTL to external equipment (Channels 1 to 4) is turned OFF. If X00 goes ON, there is a problem with the A64BTL hardware.

(2) External output enabled flags (X01 to X04)

When Y11 to Y14 (Ch. 1 to 4 external output enable flags) go ON, the ON/OFF position data is read, and comparison processing is enabled. Following this, X01 to X04 (external output 0 to F enabled flags) go ON.

(3) Error flag (X05)

This goes ON if one of the errors described in Chapter 6 occurs. The X05 flag can be turned OFF by cancelling the cause of the error and turning ON Y15 (error reset signal).

(4) Disconnected wiring detection flags (X06 to X09)

These go ON if one of the four channels (CH. 1 to 4) has not been wired or has been disconnected, or if 24 VDC is not being supplied on the linear scale side. They go OFF automatically when the problem has been corrected.

(5) Forced output mode instruction (Y10)

Turning on the forced output mode instruction signal initiates the forced output mode and outputs the values in the forced output data area (address 78) in the buffer memory to an external destination.

POINT

- Before using the forced output mode, all of the external output enabled signals should be turned OFF. If any of the external output enabled signals are ON, the forced output mode is ignored.
- If Y10 is turned ON and a forced output is initiated, external output enabled signals will be ignored even if they go ON, and the forced output mode will continue to be effective.

---

(6) External output enabled (Y11 to Y14)

Turning ON an external output enabled signal initiates comparison processing of the comparison data for CH. 1 to CH. 4 and the counter value, and outputs the results to an external destination.

Y11 .... CH. 1 external output enable
Y12 .... CH. 2 external output enable
Y13 .... CH. 3 external output enable
Y14 .... CH. 4 external output enable

(a) The comparison processing is run when Y11 to Y14 are ON. To determine the timing at which the processing is carried out, the last START/STOP input signal during the 2 msec of the INT output signal cycle is used as the measured value, and the measured value is compared with the set value. The results of the comparison are output within 2.8 ms after INT signal is output.
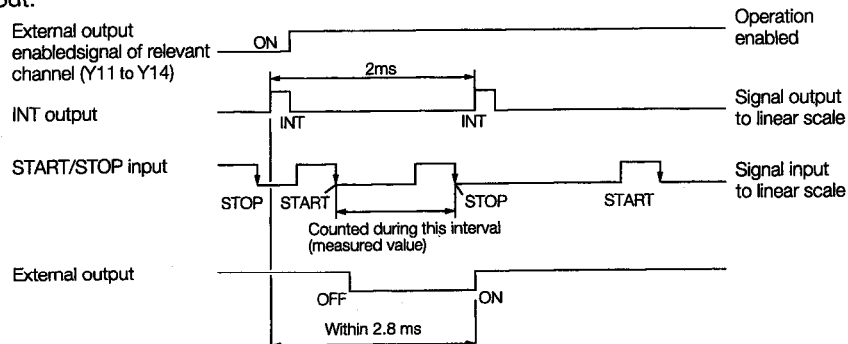
(b) Up to 4 ON/OFF position data can be compared to one measured value, and the results output to an external destination.

(c) Turning OFF an external output enabled signal (Y11 to Y14) during output of data to an external destination causes the corresponding external output to go off as well.

(7) Error reset (Y15)

Turning ON the error reset signal (Y15) turns OFF the error flag (X05) for the A64BTL error and clears to error code stored in the error code area (address 9) of the buffer memory, writing "0" to that address instead.
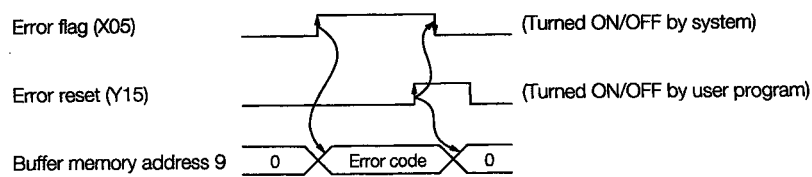
(8) Zero point correction setting (Y17 to Y1A)

To correct the zero point, move the linear scale pointer to the position to be used as the zero point, and turn on whichever setting (Y17 to Y1A) corresponds to the linear scale. This completes correction of the zero point. (Always make sure Y10 and all external output enable signals are turned OFF.)
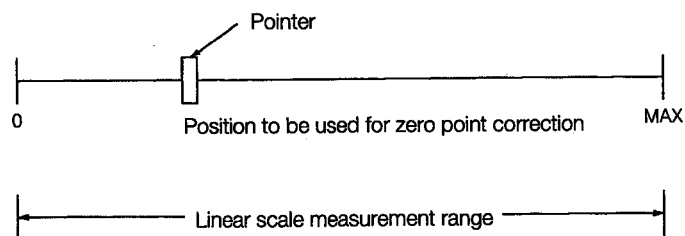
NOTE

Of the setting value data for the four ON/OFF positions, if the ON position data of any one data element is a higher value than the OFF position data (error), no comparison processing can be carried out for that measured value. If there are no errors in the setting value data for the ON/OFF positions of any of the other channels, however, comparison processing can be continued.

3 - 5

3.4 Buffer Memory

3.4.1 Buffer Memory Allocation

The A64BTL has a buffer memory for storing data being sent to and received from the CPU (this buffer memory does not have battery backup). This section described the buffer memory allocation and the data configuration.

When the system is booted, the buffer memory access instruction should always be issued through the sequence program. (When the power supply is turned off, the values for data written to this buffer memory return to the initial values.)

Address (decimal)		Default value	Read	Write	Detailed Information
0 / 1	Input CH. 1 measured value				
2 / 3	Input CH. 2 measured value	0	Enabled	Disabled	Section 3.4.2 (1)
4 / 5	Input CH. 3 measured value				
6 / 7	Input CH. 4 measured value				
8	External output status	0	Enabled	Disabled	Section 3.4.2 (2)
9	Error code	0	Enabled	Disabled	Section 3.4.2 (3)
10	CH. 1 actual supersonic speed correction value				
11	CH. 2 actual supersonic speed correction value	28500	Enabled	Enabled	Section 3.4.2 (4)
12	CH. 3 actual supersonic speed correction value				
13	CH. 4 actual supersonic speed correction value				
14 / 15	ON position data for output 0				
16 / 17	OFF position data for output 0				
⋮	⋮	0	Enabled	Enabled	Section 3.4.2 (5)
74 / 75	ON position data for output F				
76 / 77	OFF position data for output F				
78	Output data for forced output	0	Enabled	Enabled	Section 3.4.2 (6)
79	Zero point correction value clear CH.	0	Enabled	Enabled	Section 3.4.2 (7)
80 / 81	CH. 1 zero point correction data				
⋮	⋮	0	Enabled	Disabled	Section 3.4.2 (8)
86 / 87	CH. 4 zero point correction data				

After the power supply has been turned on, the value used for zero point correction is stored in the E^{2}PROM, and remains in the memory if the power supply is turned off and then on again.

3.4.2 An Explanation of the Storage Area

(1) Input channel measurement values

The measured values for the supersonic linear scale BTF pointer are stored in addresses 0 to 7. Measured values are carried to three decimal places and multiplied by 1000.

(Example) A value of 125.371 mm will be entered as "125371".

(2) External output status

The results of a comparison between the measured values for CH. 1 to 4 and the specified ON/OFF positions are entered as the output status.

The table below shows the relation between the various measured values and the ON/OFF position data when compared.

CH. 1 measured value	ON/OFF positions for output 0 to 3
CH. 2 measured value	ON/OFF positions for output 4 to 7
CH. 3 measured value	ON/OFF positions for output 8 to B
CH. 4 measured value	ON/OFF positions for output C to F

Comparison results

- ON position data $\leq$ measured values for CH. 1 to 4 $<$ OFF position data

  ············· a value of "1" is entered.

- ON position data $>$ measured values for CH. 1 to 4

  or

  measured values for CH. 1 to 4 $\geq$ OFF position data

  ············· a value of "0" is entered.

POINT

With the A64BTL, measured values (counter values) are sampled at 2-msec intervals. The measured values are then compared to the specified ON/OFF position data and the results output.

Consequently, no external output status is output for movements occurring with a 2-msec interval.

(Example) The measured value for CH. 1 is compared to the four ON/OFF positions shown below.
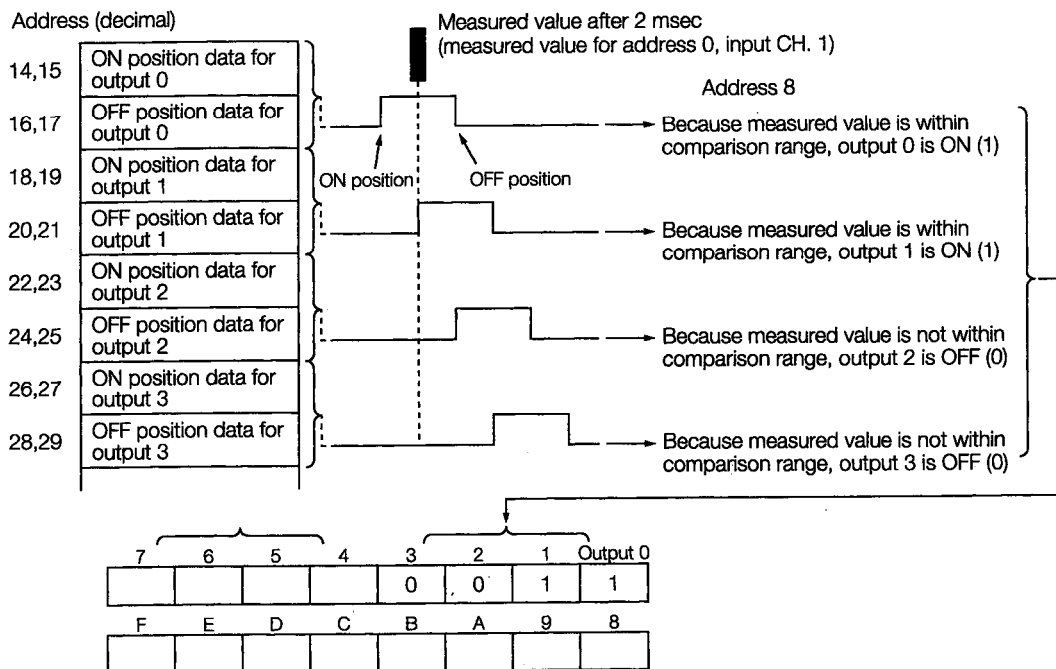
The output statuses for the comparison results are also entered in outputs 4 to F.

NOTE

If it is not necessary to set all four of the ON/OFF positions, errors can be avoided by entering the same values for the ON/OFF position data of outputs which do not need to be set.

(Example) If ON/OFF settings are not needed for CH. 1-2

ON position for CH. 1-0 : 10 mm / OFF position for CH. 1-0:   40 mm
ON position for CH. 1-1 : 30 mm / OFF position for CH. 1-1:   60 mm
| ON position for CH. 1-2 : 50 mm / OFF position for CH. 1-2:   50 mm |
ON position for CH. 1-3 : 50 mm / OFF position for CH. 1-3: 100 mm

(3) Error codes

Turning ON the error flag (X05) enters an error code in address 9 of the buffer memory. (Normally, 0 is entered in this address.)

For detailed information on error codes, please refer to Chapter 6.

(4) Actual supersonic speed correction values

Actual supersonic speed correction values are used to correct solid differences between actual supersonic speed values on the supersonic linear scale BTL, in order to obtain more precise measurements. Values which are entered should always be created by rounding off the fraction of the value displayed on the linear scale (see Appendix 1.2) and multiplying the value by 10.

(a) The measured values are created by carrying out position correction based on these values. (When not setting, the measured values are created by carrying out position correction with default values.)

(b) Values higher than "28999" should not be set for the actual supersonic speed. Please be aware that no error is displayed even if a value outside of the allowable range is entered.

Address (decimal)

10	CH. 1 actual supersonic speed correction value
11	CH. 2 actual supersonic speed correction value
12	CH. 3 actual supersonic speed correction value
13	CH. 4 actual supersonic speed correction value

(5) ON/OFF position data for outputs 0 to F

Because these values are compared with the measured values input for CH. 1 to 4 and are written when Y11 to Y14 (external output enabled signals) are turned ON, they should be specified before Y11 to Y14 are turned ON.

(a) The setting range for ON/OFF position data is from -16777.216 to 16777.215 mm, but the values written to the buffer memory should be multiplied by 1000.

(Example) 123.456 → 123456

(b) The setting range should consist of two words.

Address (decimal)

14 / 15	ON position data for output 0
16 / 17	OFF position data for output 0
18 / 19	ON position data for output 1
20 / 21	OFF position data for output 1
22 / 23	ON position data for output 2
24 / 25	OFF position data for output 2
26 / 27	ON position data for output 3
28 / 29	OFF position data for output 3

CH.1

(6) Output data for forced outputs

When the forced output mode instruction (Y10) is turned ON, 16-point external output is carried out based on the output data.

(Example) If the output data is 0111H:

7	6	5	4	3	2	1	Output0
0	0	0	1	0	0	0	1

F	E	D	C	B	A	9	8
0	0	0	0	0	0	0	1

1 : ON
0 : OFF

Of the outputs 0 to F, only outputs 4, 8, and F are turned on.

(7) Zero point correction value clear CH.

To clear the zero point correction value data for CH. 1 to 4, stored in the E²PROM, write the channel number (1 to 4) to which the linear scale to be cleared is connected.
If a value of "5" is entered, the zero point correction values for all of the channels are cleared to zero.

(a) No values other than 1 to 5 should be written, as other values will cause an error.

(b) When the zero point correction values have been cleared to zero, a value of "0" is written to address K79. The zero clear processing is not carried out if a value of "0" is written.

To clear CH. 1 to zero	→ Write "1".
To clear CH. 2 to zero	→ Write "2".
To clear CH. 3 to zero	→ Write "3".
To clear CH. 4 to zero	→ Write "4".
To clear all of the channels to zero	→ Write "5".

(8) Zero point correction data

The zero point correction data is written to the E²PROM by turning ON the zero point correction settings (Y17 to Y1A). The values for the positions at which zero point correction was carried out are also written from the E²PROM to addresses 80 to 87 in the buffer memory.

POINT

If an error occurs during the zero point correction processing and the error continues to occur even after it has been corrected several times, there is a problem with the hardware. If this happens, the unit should be replaced.

---

4. Settings and Procedures Prior to Operation

This section describes what to do to get ready for operation, as well as precautions concerning handling of the equipment, names of parts, and the various functions.

4.1 Preparing for Operation

Fig. 4.1 shows the process used to prepare for operation.

```
                    ┌─────────────────────────────┐
                    │            Start            │
                    └──────────────┬──────────────┘
                                   │
  ┌────────────────────────────────────────────────┐
  │ Specify type of supersonic linear scale BTL.    │
  ├────────────────────────────────────────────────┤        ······ See  Section 4.3
  │ • For each channel, install the short-circuit arm that matches
  │   the type (P or M) of linear scale which has been connected.
  └────────────────────────────────────────────────┘
                                   │
  ┌────────────────────────────────────────────────┐
  │ Unit installation                               │
  ├────────────────────────────────────────────────┤
  │ • Install the A64BTL in the specified slot.     │
  └────────────────────────────────────────────────┘
                                   │
  ┌────────────────────────────────────────────────┐
  │ Wiring external power supply                    │
  ├────────────────────────────────────────────────┤
  │ • Connect the 24 VDC power supply for the external output
  │   circuit to the A64BTL.
  └────────────────────────────────────────────────┘
                                   │
  ┌────────────────────────────────────────────────┐
  │ Wiring                                          │
  ├────────────────────────────────────────────────┤
  │ • Wire the A64BTL and the peripheral equipment. │
  │ • Wire the power supply for the linear scale.   │
  └────────────────────────────────────────────────┘
                                   │
  ┌────────────────────────────────────────────────┐
  │ Programming and debugging                       │
  ├────────────────────────────────────────────────┤
  │ • Create and check the sequence program to control the
  │   A64BTL.
  └────────────────────────────────────────────────┘
                                   │
                    ┌─────────────────────────────┐
                    │            End              │
                    └─────────────────────────────┘
```

Fig. 4.1 Preparation procedure

4.2   Precautions Concerning Handling

This section explains the precautions that should be observed when handling the A64BTL.

(1) The case and terminal base of the A64BTL are made of resinous materials, and should be protected from strong impact, such as being dropped.

(2) The PCB of the A64BTL should not be removed from the case, as this can cause breakdowns.

(3) Terminal screws should be tightened within the ranges given below.

Screw Location	Tightening Torque Range
I/O terminal base screws (M3 screws)	49 to 78 N-cm
I/O terminal base attachment screws (M4 screws)	78 to 137 N-cm

⚠ **DANGER**
- Never touch the terminals while conductivity is being supplied. This can cause faulty operation.
- Cleaning and additional tightening of terminal screws should be done with the power supply turned OFF. Adjusting screws with the power supply on can cause breakdowns and faulty operation.

⚠ **CAUTION**
- When installing the unit, first insert the projection on the bottom of the base unit which secures it in place firmly into the hole provided in the base unit, and then install the unit.
  Failing to install the unit correctly can result in faulty operation, breakdowns, and the unit being dropped or falling over.
- Terminal screws should be tightened to the specified torque.
  Loose terminal screws can cause short circuits, fire, and faulty operation.
- Be careful to keep foreign matter such as filings and wire scraps out of the unit. These can cause fire, breakdowns, and faulty operation.
- Before wiring the unit, check the rated voltage and the terminal layout, and make sure the wiring is done correctly.
  Connecting a power supply with the wrong specifications, or wiring the power supply incorrectly, can cause fire and breakdowns.
- Never disassemble or renovate the unit.
  This can cause breakdowns, faulty operation, injuries, or fire.
- Turn the power supply OFF before installing or removing the unit.
  Installing or removing the unit with the power supply on can cause it to break down, or can cause faulty operation.

4.3 Names of Parts

Names of A64BTL Parts
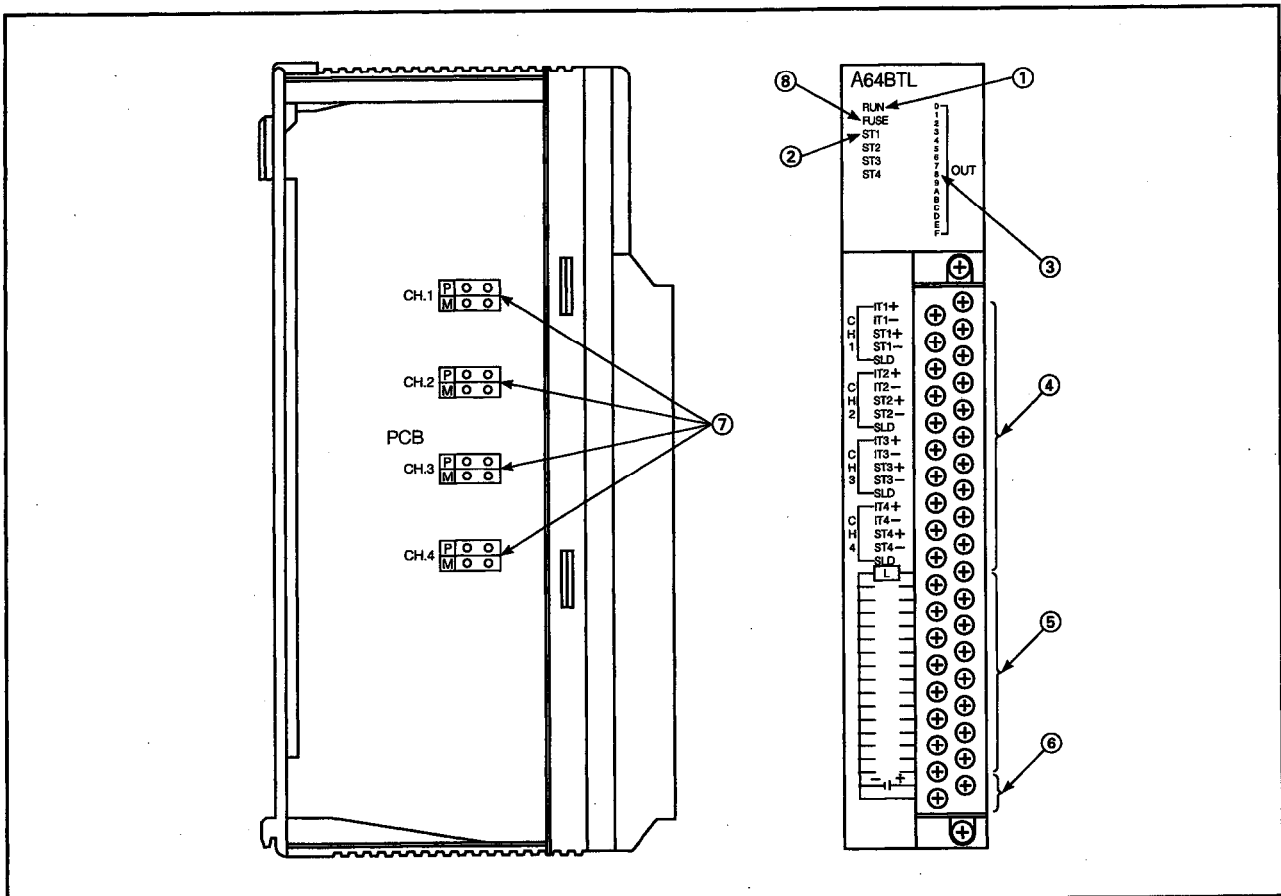
No.	Signal and Appearance	Contents
①	"RUN" LED	This LED indicates the operation status of the A64BTL. Lighted: • Operating normally Not lighted: • Power is not being supplied to the A64BTL. • A WDT error has occurred in the A64BTL. • A hardware problem has occurred with the A64BTL. • The CPU has detected an error and stopped the operation.
②	"ST1 to ST4" LED	When START/STOP signals are received from the various channels, the corresponding LED lights. The brightness varies depending on the length of the linear scale measurement. (The LED is brighter for a long measurement and dimmer for a short measurement.)
③	"OUT" LED	This LED lights when the output is ON as a result of comparison processing of the measured values from the various channels.
④	Linear scale signal wire connection terminal	These are used to read the linear scale signals from the various channels.
⑤	External output terminal	The results of the comparison between the measured value and the ON/OFF position data are output as an output signal.
⑥	Power supply input terminal	These are the input terminals for the external power supply (24 VDC). They are also used to output external output signals.
⑦	Micropulse linear scale BTL type selection pin	Short-circuit arms are installed here to match the type (P or M) of linear scale connected to the various channels.
⑧	"FUSE" LED	This is the fuse for external supply power (DC24V). This LED lights when the fuse is blowed by over current or when the wiring is not connected for external supply power.

4.4   Wiring

This section describes precautions which should be followed when wiring the A64BTL, as well as how the A64BTL is wired to peripheral equipment.

4.4.1   Precautions Concerning Wiring

In order to take full advantage of the many functions of the A64BTL and assure high reliability of the system, it is important to make sure the external wiring minimizes the effects of noise as much as possible.

The following precautions should be observed when connecting the wiring.

(1) Separate cables should be used for connecting the AC and the external output signals of the A64BTL, and for the 24 VDC input. Steps should be taken to protect against surges and inductance on the AC side.

(2) Single-point grounding should be used for the shielding on shielded wires and shielded cables.

⚠ CAUTION	• Control cables and communications cables should not be bundled with main circuits and power cables, and should be kept well separated. As a rule, cables should be separated by at least 100 mm, to prevent faulty operation because of noise interference.

4.4.2   Wiring the A64BTL and Peripheral Equipment

(1) Fig. 4.2 shows an example of how the A64BTL should be wired to peripheral equipment.
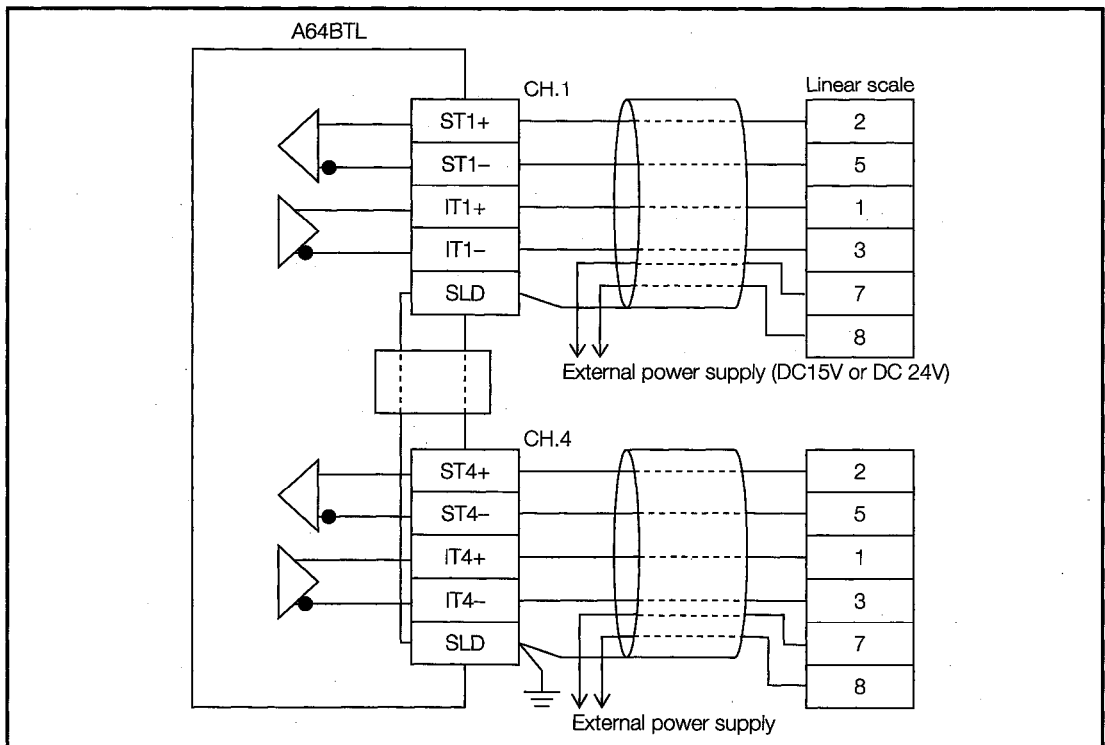
Fig. 4.2 Wiring the A64BTL and peripheral equipment

⚠️**CAUTION**
- The SLD terminal should always be grounded using a Class D or higher ground used for the PC alone, and not shared with other equipment.

4.4.3   Connecting an External Power Supply to the A64BTL

The following shows how to connect an external power supply to the A64BTL.

(1) In order to prevent electromagnetic inductance noise and other noise interference, twisted-pair wiring should be used for connections.
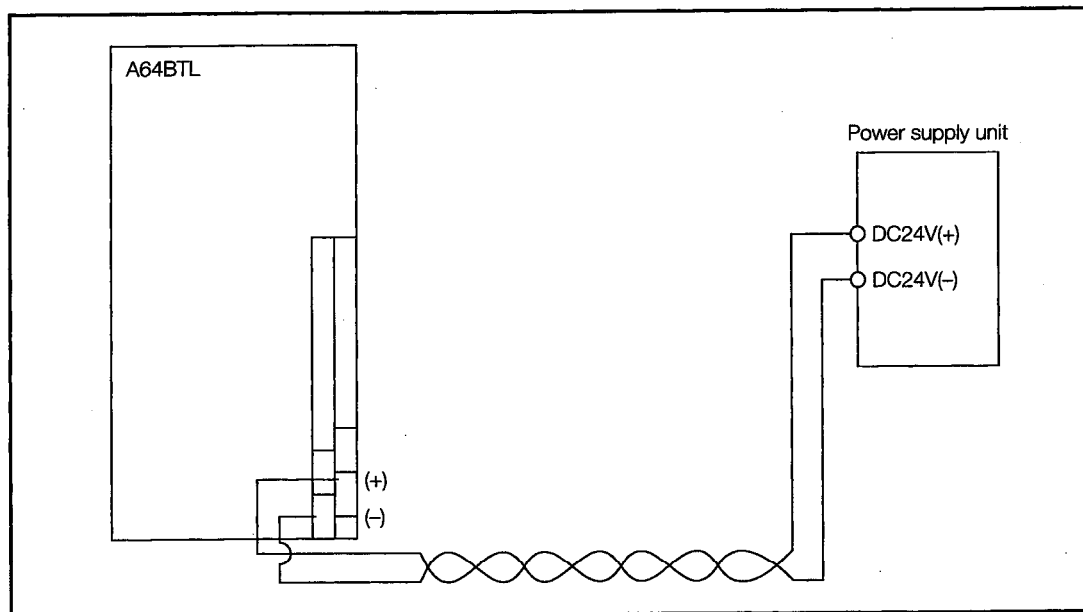
Fig. 4.3 Connecting the A64BTL to an external power supply

MEMO

5. Programming

This section describes the programming method used with the A64BTL.

5.1 Programming Procedures

Fig. 5.1 shows the procedure by which a program is created when reading and writing data between the CPU and A64BTL.
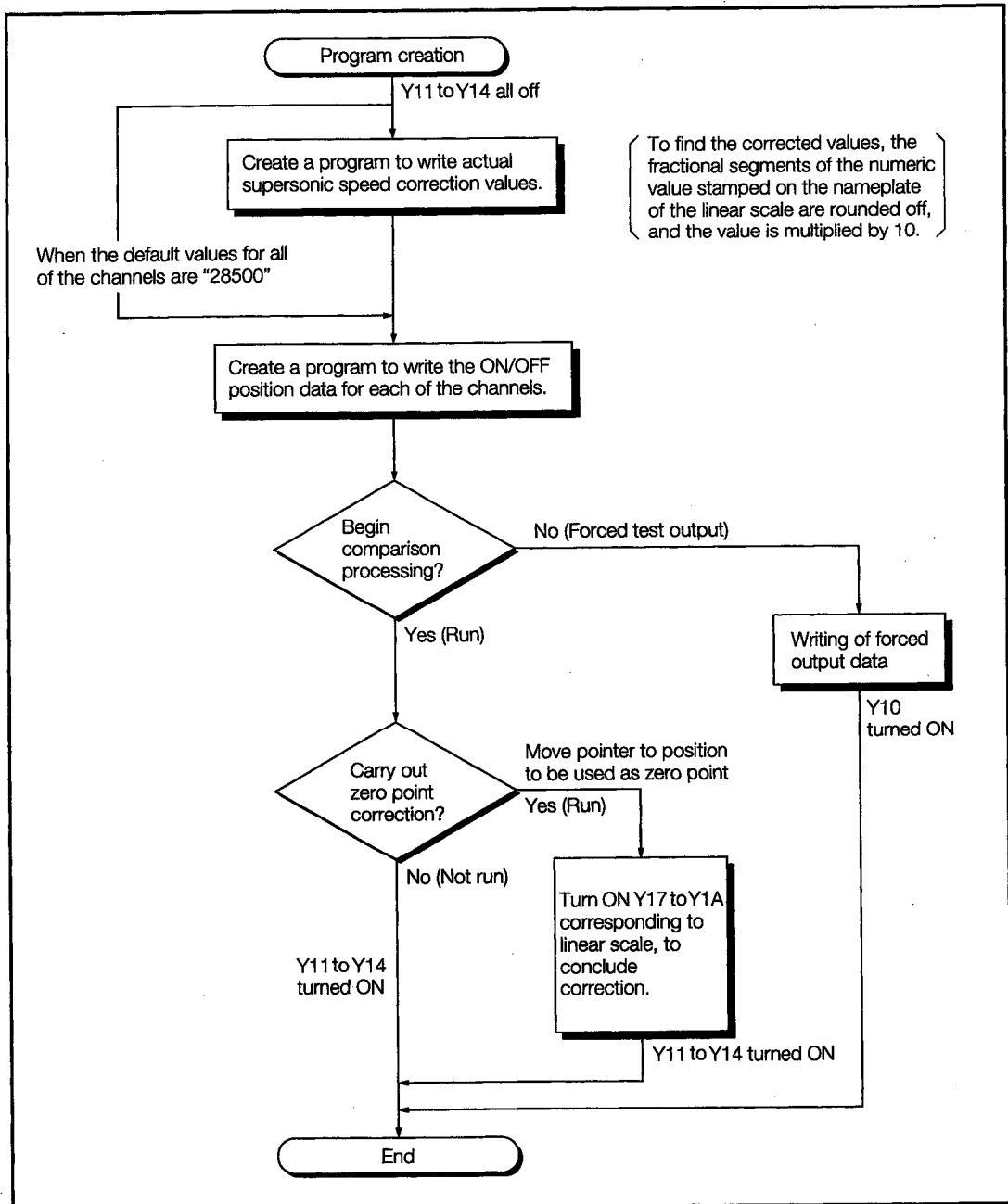
Fig. 5.1 Programming procedure

5.2 Programming Examples

This example shows a program which first writes the actual supersonic speed correction values of the various linear scales as initial values, then writes the set values for the ON/OFF positions of each of the channels and begins comparing the values.

The processes for forced output, clearing the zero point correction values to zero, and zero point correction set are also shown, as related programs.

Conditions for Sample Program

(1) System configuration

Power supply unit	A3ACPU	A64BT	AX42 64 points	AY42 64 points		

X/Y00   X20   Y60
to   to   to   ⎫
                  ⎬ ········· I/O numbers
X/Y1F   X5F   Y9F   ⎭

(2) Contents of initial settings

    (a) Actual supersonic speed correction values ....CH. 1: 28000

                                                                                       CH. 2: 27000

    (b) Set values for ON/OFF positions .... ON position for output 0: 1200

                                                                 OFF position for output 0: 1600

(3) Devices used by the user

    (a) Command for writing ON/OFF position data for output 0 to 3 .... X21

    (b) Command for writing forced output data X25

    (c) Command for clearing CH. 1 zero point correction value X2A

    (d) Registers for storing CH. 1 and CH. 2 actual supersonic speed correction values .... D0 and D1

    (e) Registers for storing ON/OFF position data for output 0 .... D4 to D7

    (f) Register for storing output data from forced output D68

    (g) Register for storing clear CH, CH. 1 zero point correction value D72

M9036 (Always ON)

——[SCJ P1]

```
Programming
procedure
    │
    ▼
Setting of initial actual
supersonic speed
correction values;
writing of CH. 1 and 2
    │
    ▼
Writing of ON/OFF
position data for
outputs 0 to 3 (CH.1)
    │
    ▼
Writing of output data
for forced output
    │
    ▼
    ①
```

X00

——[MOV K 28000 D0] -- CH.1 corrected value of 28000 is written to D0

——[MOV K 27000 D1] -- CH.2 corrected value of 27000 is written to D1

——[TO H K 0 10 D0 K1] -- Value of D0 is written to address 10

——[TO H K 0 11 D1 K1] -- Value of D0 is written to address 11

CH. 3 and CH. 4 are set in the same way as above.

P1 X00 X21

——[RST Y10] -- Forced output reset

——[TOP H K K 0 78 0 K1] -- Forced output data clear

——[DMOVP K 1200 D4] -- ON position data of 1200 for output 0 is stored in D4 and D5

——[DMOVP K 1600 D6] -- OFF position data of 1600 for output 0 is stored in D6 and D7

——[DTOP H K 0 14 D4 K2] -- Data for D4 to D7 is written to addresses 14 to 17

Setting of ON/OFF position data for outputs 1 to 3

Y10

——[SET Y11] -- CH.1 external output enable

X00 X□

Reading of ON/OFF position data for outputs 4 to F (CH.2 to CH.4) is done in the same way as above.

X00 X25

——[MOVP K 0 K1Y11] ---- All outputs enable clear

——[MOVP H 0111 D68] --- Data to turn on only outputs 0, 4, and 8 is written to D68

——[TOP H K 0 78 D68 K1] --- Data for D68 is written to address 78

Y11 Y12 Y13 Y14

——[SET Y10] --- Forced output is implemented

5 - 3

①

```
                                                                    ┌RST    Y10 ┐--Forced output reset
┌──────────────────┐         X00   X26                              └          ┘
│ Zero point       │          ╫╫───┤├───┐                                K
│ correction       │──▶                 │          ┌MOVP   0    K1Y11┐--All outputs enable clear
│ for CH. 1 is set │                    │          └                 ┘
└──────────────────┘              Y10   Y11 Y12 Y13 Y14                        Zero point correction for
        │                          ╫╫──┤├─┤├─┤├─┤├──┤├──┌PLS    Y17┐---CH.1 is set
        │                                              └          ┘
        ▼                     X00   X ⌐⌐                ┌──────────────────────────────────┐
┌──────────────────┐          ╫╫───┤├──┤├──│Zero point correction for CH. 2 to CH. 4 is │
│ Zero point       │                        │set in the same way as above.              │
│ correction       │          X00   X2A     └──────────────────────────────────────────┘
│ value for CH. 1 is│─▶       ╫╫───┤├───                ┌RST    Y10 ┐--Forced output reset
│ cleared          │                                   └          ┘
└──────────────────┘                                         K
        │                                        ┌MOVP   0    K1Y11┐--All outputs enable clear
        │                                        └                 ┘
        ▼                                              K          Zero point correction value
  ( End )                                       ┌MOVP   1    D72 ┐-clear CH. is set for CH.1
                                                └                ┘
  Error detection circuit                          H   K        Zero point correction value
┌──────────────────┐          X00   X ⌐⌐      ┌TOP 0  79   D72   K1┐for CH.1 is cleared
│                  │          ╫╫───┤├──┤├──  ┌──────────────────────────────────┐
│  Error detection │─▶                       │Zero point correction value data for CH. 2│
│                  │          X05            │to CH. 4 is cleared in the same way as    │
└──────────────────┘          ┤├───────────  └──────────────────────────────────────┘
                              Error                  ┌SET    Y40 ┐ Error detection
                              flag                   └          ┘
                                                         H   K
                                             ┌FROM 0  9   D80   K1┐ Error code is read to D80
                                             └                    ┘
                                                   ┌BCD  D80  K2 Y50┐ Error code is displayed
                                                   └                ┘
                              X2E   Y40          K
┌──────────────────┐          ┤├───┤├──┌──────┌=  10   D80 ┐────┌RST   Y11 ┐┐
│                  │          Error reset       └            ┘    └          ┘│
│                  │                             K                            │When ON/OFF position data
│                  │                        ┌= 11   D80 ┐──────┌RST   Y12 ┐  │setting is mistaken, external
│                  │                        └            ┘       └          ┘ │output enable for
│                  │                             K                            │correspouding CH.is cleared
│  Error reset     │─▶                      ┌= 12   D80 ┐──────┌RST   Y13 ┐  │
│                  │                        └            ┘       └          ┘ │
│                  │                             K                            │
│                  │                        ┌= 13   D80 ┐──────┌RST   Y14 ┐┘
│                  │                        └            ┘       └          ┘
└──────────────────┘                                         ┌SET   Y15 ┐ Error reset
                                                             └          ┘
                                                             ┌RST   Y40 ┐ Error detection clear
                                                             └          ┘
                                                                  K
                                                        ┌MOVP  0    K2Y50┐ Error code display clear
                                                        └                ┘
┌──────────────────┐          X06                                  <Y41 > CH.1 wire breakage detection
│  Wire breakage   │─▶        ┤├─ CH.1 wire breakage
│  detection       │
└──────────────────┘          ┌──────────────────────────────────────────────┐
                              │Wire breakage detection for CH.2 to CH.4 is programed in the same way│
                              │as above.                                       │
                              └──────────────────────────────────────────────┘
```

6. Troubleshooting

This section describes the contents of errors which may occur while using the A64BTL, and the appropriate troubleshooting measures that should be taken.

6.1 Table of Error Codes

This section shows the A64BTL error codes. If the A64BTL detects an error, X05 goes ON, and the error code is written to address 9 in the buffer memory.

Table 6.1 Error Codes

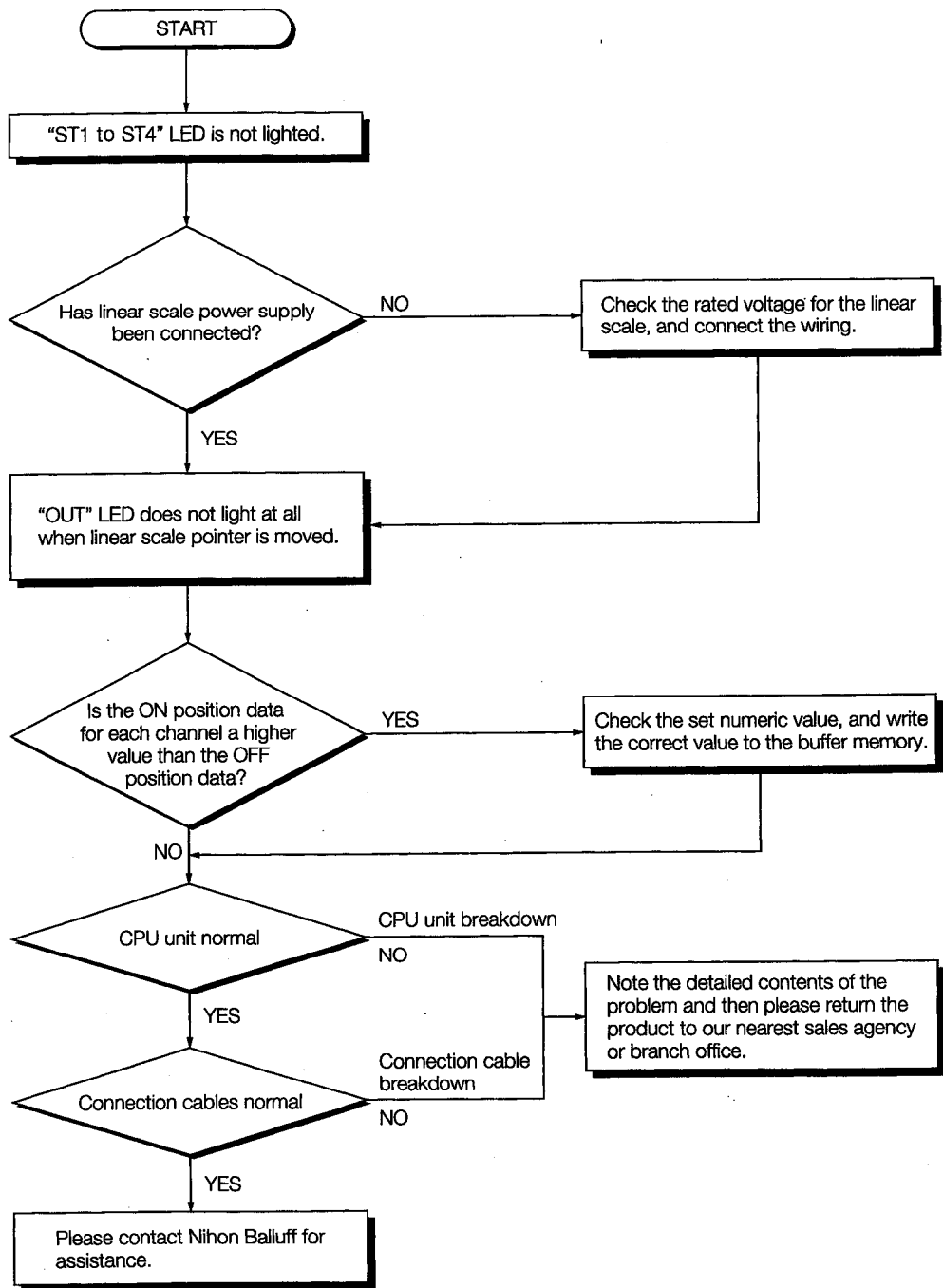| Cause		Error Code	Solution
Normal		00	
If ON position data > OFF position data	ON positions for outputs 0 to 3 / OFF positions for outputs 0 to 3	10	Check the specified numeric value and correct it.
	ON positions for outputs 4 to 7 / OFF positions for outputs 4 to 7	11	
	ON positions for outputs 8 to B / OFF positions for outputs 8 to B	12	
	ON positions for outputs C to F / OFF positions for outputs C to F	13	
Data other than 1 to 5 was written to address 79.		14	
An instruction was written to an address outside the allowable area (addresses 10 to 79).		20	Check the sequence program and correct it.
The zero point correction value for CH. 1 was not written correctly to the E²PROM, or the value could not be cleared to zero.		40	Write the zero point correction value again.
The zero point correction value for CH. 2 was not written correctly to the E²PROM, or the value could not be cleared to zero.		41	
The zero point correction value for CH. 3 was not written correctly to the E²PROM, or the value could not be cleared to zero.		42	
The zero point correction value for CH. 4 was not written correctly to the E²PROM, or the value could not be cleared to zero.		43	

NOTE

• Each time an error occurs, the most recent error code is set. Errors can be reset (the error code cleared) by turning Y15 on through the PC CPU.

• If an error is not reset, the last error code set will remain even if all of the data entered is correct.
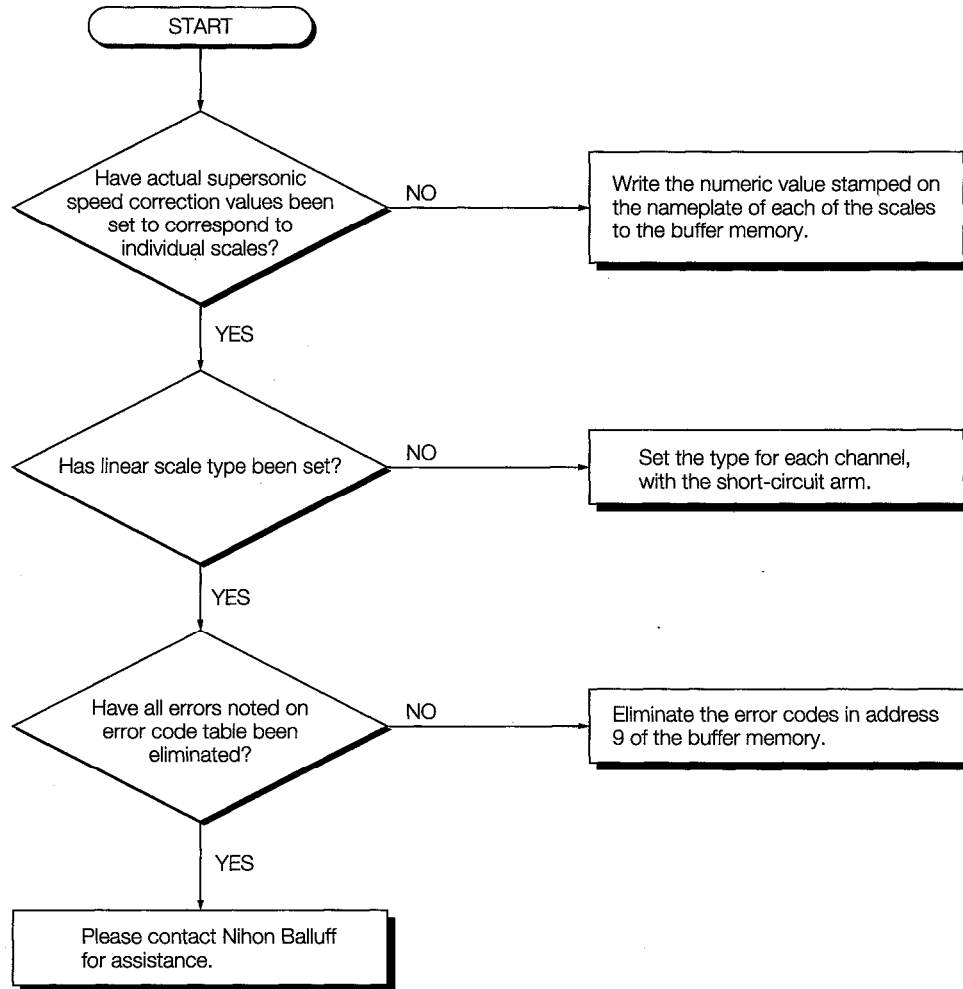
6.2   Troubleshooting

This section explains simple troubleshooting procedures which can be carried out while using the A64BTL.

For items relating to the sequencer CPU unit, please refer to the User's Manual for the sequencer CPU being used.

6.2.1   External Output Signal is not Output

```
                      ┌─────────────┐
                      │    START    │
                      └─────────────┘
                             │
                  ┌──────────────────────────┐
                  │ "ST1 to ST4" LED is not  │
                  │ lighted.                 │
                  └──────────────────────────┘
                             │
                        ◇ Has linear scale      NO     ┌──────────────────────────────┐
                          power supply ─────────────── │ Check the rated voltage for  │
                          been connected? ◇            │ the linear scale, and connect│
                             │ YES                      │ the wiring.                  │
                                                        └──────────────────────────────┘
                  ┌──────────────────────────┐
                  │ "OUT" LED does not light │
                  │ at all when linear scale │
                  │ pointer is moved.        │
                  └──────────────────────────┘
                             │
                        ◇ Is the ON position     YES    ┌──────────────────────────────┐
                          data for each channel ─────── │ Check the set numeric value, │
                          a higher value than          │ and write the correct value  │
                          the OFF position data? ◇      │ to the buffer memory.        │
                             │ NO                        └──────────────────────────────┘
```

CPU unit breakdown

```
                  ◇ CPU unit normal ◇ ─── NO ───┐
                             │ YES               │
                                                 │    ┌──────────────────────────────┐
                  ◇ Connection cables    Connection│   │ Note the detailed contents of│
                    normal ◇ ─── NO ───  cable     │   │ the problem and then please  │
                             │ YES       breakdown │   │ return the product to our    │
                                                   │   │ nearest sales agency or      │
                  ┌──────────────────────────┐     │   │ branch office.               │
                  │ Please contact Nihon     │     │   └──────────────────────────────┘
                  │ Balluff for assistance.  │
                  └──────────────────────────┘
```

6.2.2   Measured Value does not Match Set Value

```
                    ┌─────────────┐
                    (    START     )
                    └──────┬──────┘
                           │
                           ▼
                    ╱─────────────╲
                  ╱  Have actual    ╲        NO      ┌──────────────────────────────┐
                 ╱ supersonic speed  ╲──────────────▶│ Write the numeric value       │
                 ╲ correction values ╱               │ stamped on the nameplate of   │
                  ╲ been set to      ╱                │ each of the scales to the     │
                   ╲ correspond to  ╱                 │ buffer memory.                │
                    ╲ individual    ╱                 └──────────────────────────────┘
                     ╲ scales?     ╱
                      ╲───────────╱
                           │ YES
                           ▼
                    ╱─────────────╲
                  ╱                 ╲       NO         ┌──────────────────────────────┐
                 ╱  Has linear scale ╲───────────────▶│ Set the type for each channel,│
                 ╲   type been set?  ╱                 │ with the short-circuit arm.   │
                  ╲                 ╱                  └──────────────────────────────┘
                   ╲───────────────╱
                           │ YES
                           ▼
                    ╱─────────────╲
                  ╱  Have all errors ╲       NO        ┌──────────────────────────────┐
                 ╱  noted on error    ╲──────────────▶│ Eliminate the error codes in   │
                 ╲  code table been   ╱                │ address 9 of the buffer memory.│
                  ╲  eliminated?     ╱                 └──────────────────────────────┘
                   ╲───────────────╱
                           │ YES
                           ▼
              ┌──────────────────────────┐
              │ Please contact Nihon      │
              │ Balluff for assistance.   │
              └──────────────────────────┘
```

┌──┐
│ **POINT**   │
│   │
│ If the problem cannot be solved by following the troubleshooting procedures, │
│ there may be a problem with the unit hardware. Please describe the problem to │
│ your nearest sales agency or branch office and request assistance.   │
└──┘

MEMO

Appendices

Appendix 1. Micropulse Linear Scale BTL Specifications

1.1 Micropulse Linear Scale BTL Specifications

This section describes the scale specifications of the micropulse linear scale BTL (made by BALLUFF of Germany) used with the A64BTL.

Model	BTL5-P □/M□-□ Profile type/Rod type/Compact rod type
Output signal	Pulsed output
Repeatability	6 μm max. (hysteresis + resolution)
Resolution	2 μm max. (based on connected controller)
Linearity	±100 um (for items where L ≦ 500 mm) ±0.02% (for items where L > 500 mm)
Temperature drift	(6 μm±5ppmxL)/°C
Impact resistance	11 ms^2 (DIN IEC68)
Vibration resistance	118m/s^2, 10 to 2000 Hz (DIN IEC68)
Allowable pointer speed	No restrictions (except that sampling delay results)
Power supply/current consumption	+24 VDC/190 mA max., or ±15 VDC/35 mA max.
Ambient temperature — Storage	–40°C to +100°C
Ambient temperature — Operating	–40°C to +85°C
Protective construction	IP67 (status of connector)
Measurement length (mm)	0 to 3750 *1
Max. cable length (m)	500
Connectors (scale side)	BKS-S32M-00 or BKS-S33M-00
Applicable cables	0.75 mm^2 (shielded cable)

Procedure for ordering scales:

BTL 5 - P 1 - M0750 - B - S32
① ② ③   ④   ⑤   ⑥   ⑦
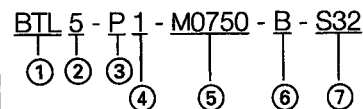
① BALLUFF supersonic linear scale
② Series 2
③ Interfaces
   START/STOP, RS-485
   P = Falling edge
   M = Rising edge (without compact rod type)
④ Power supply voltage
   1 = 24 VDC ± 10%
   2 = ± 15 VDC ± 2%
⑤ Nominal length of scale: See NOTE (2)
⑥ Shapes
   P = Profile type
   K = Compact rod type
   B = Rod type flange attachment screw M18 x 1.5
   Z = Rod type flange attachment screw 3/4-16UNF
⑦ Connections
   S32 = Connector connection, S32 type
   KA05 = Cable connection, cable length 5 m
   (cable connection models are available only in rod type configurations)

NOTE

(1) When ordering the micropulse linear scale, in addition to specifying the model of scale, instructions must also be included concerning the type of pointer and the connector for the scale to be used (both ordered separately).

(2) The following nominal lengths are available for the scales indicated under *1 above:
     0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750
     3850mm available for the rod type.

1.2 Outer Dimension Drawings of Micropulse Linear Scales BTL

Profile type

When floating pointer is used
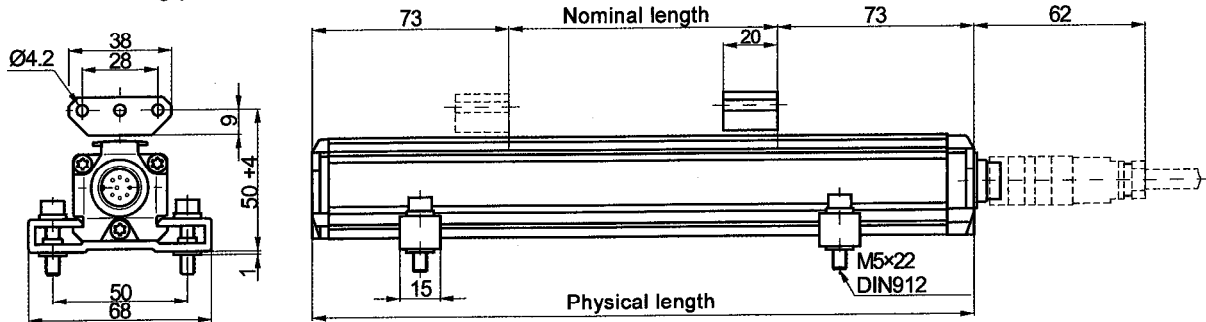
When slide pointer is used
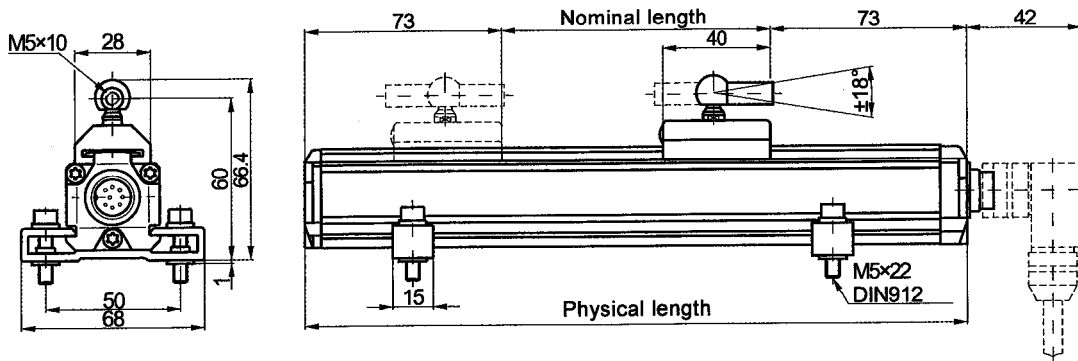
Nominal length (mm)	0050, 0100, 0130, 0150, 0175, 0200, 0225, 0250, 0300, 0350, 0360, 0400, 0450, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1250, 1300, 1400, 1500, 1600, 1700, 1750, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3550, 3750

Pointer
(Optional)

Floating pointer
BTL5-P-3800-2
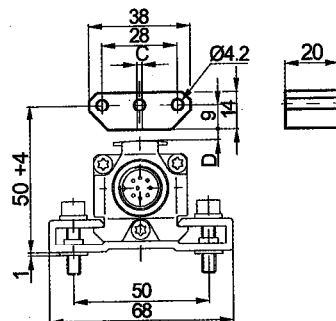
Supplied with two brass screws (M4×25), six nuts and six washers for fixing.
Magnetic metal screws cannot be used.
In the area where the pointer will be installed, magnetic metal cannot be used, either.

Slide pointer
BTL5-F-2814-1S

M5×10 28 40 ±18°

M5×10 28
24 30.4
66.4 60
1
50
68
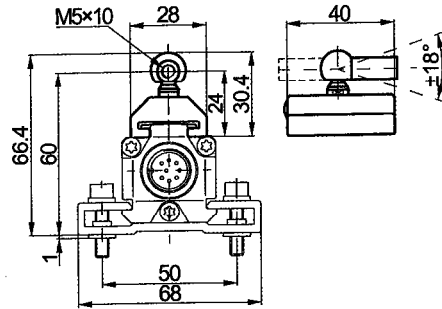
Connection shaft for
slide pointer
(Optional)

Dimension LS can be
specified in mm.

LG
24 LS 24
13° 13°
Ø10
Ø5 M7
Fixing nut M5 DIN934
Rod end DIN648
Supplied to connection
knuckle DIN71802
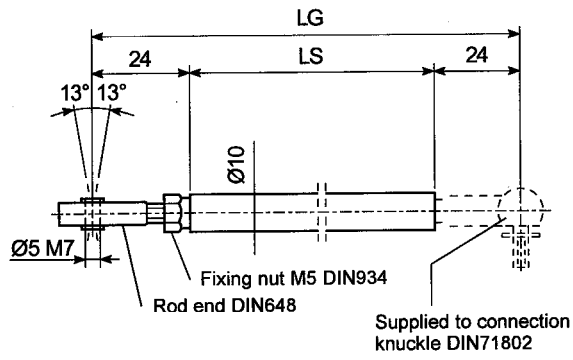
Guide to ordering
connection shaft

Connection shaft   BTL 2 - GS 10 - 0100 - A

BALLUFF micropulse linear scale
Series 2
Connection shaft
Outline, 10mm
Shaft length (LG), mm
Material
A = Aluminum

Rod type

Interface		A(mm)	B(mm)	C(mm)
Analog	A, E, C, G	74	69	48
Digital	P, M, I	57	69	48
SSD	S	74	69	48
CAN open	H	85. 5	73	51
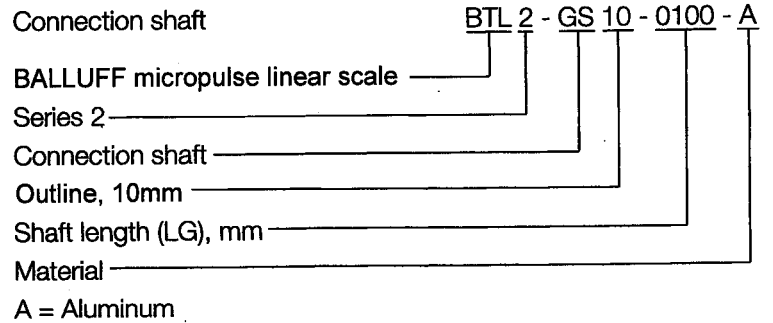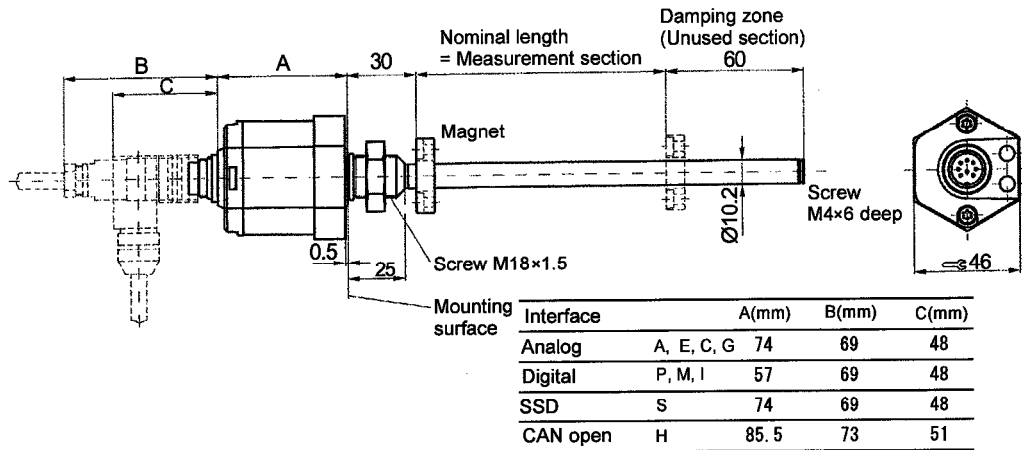
Compact rod type
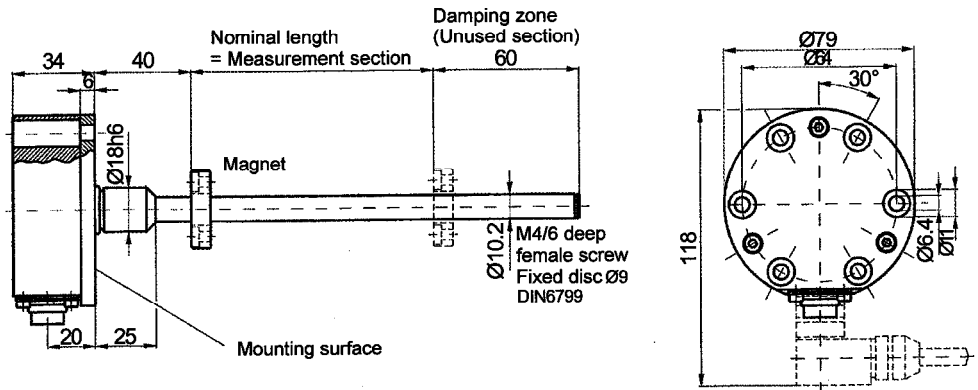
Nominal length (mm)	0025, 0050, 0075, 0100, 0125, 0150, 0175, 0200, 0225, 0250, 0275, 0300, 0325, 0350, 0375, 0400, 0425, 0450, 0475, 0500, 0550, 0600, 0650, 0700, 0750, 0800, 0850, 0900, 0950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2250, 2500, 2750, 3000, 3250, 3500, 3750, 3850, or in 5mm increments on request

Pointer
(Optional)
Common to rod and
compact rod types

BTL-P-1013-4R   BTL-P-1013-4S   BTL2-S-3212-4Z   BTL2-S-4414-4Z
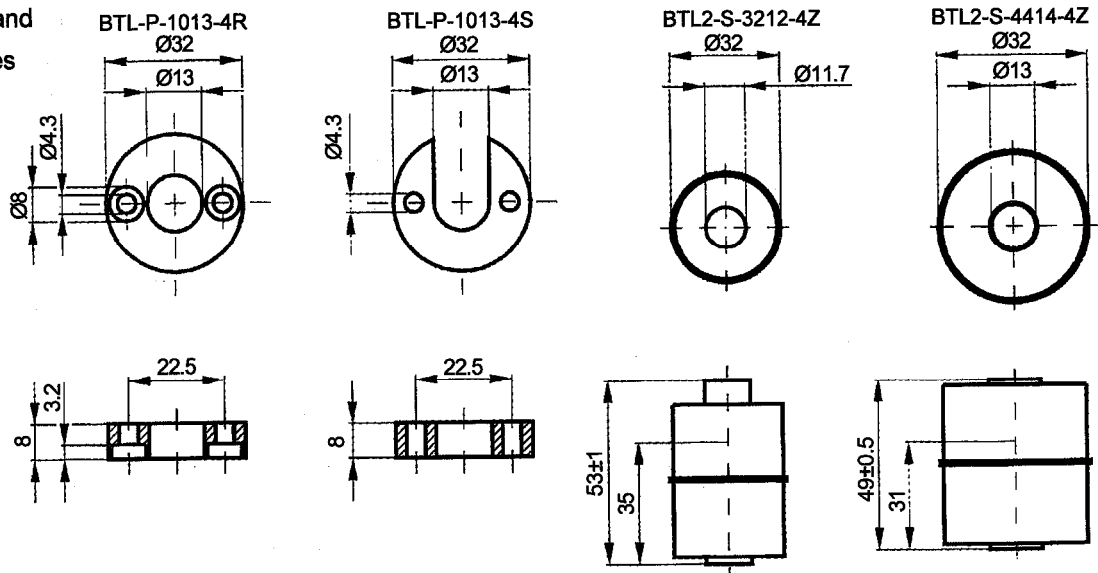
Connector for scale
(Optional)

BKS-S 32M-00   BKS-S 33M-00
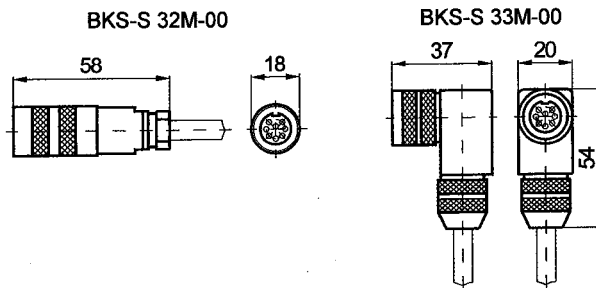
- Use the same connector for the profile type and rod type.
- Use the connector made by the German company, Binder (commercially available).

Location of actual supersonic speed correction value stamp

| Profile type |

Nameplate

BALLUFF

Stamp indicating actual supersonic speed
correction value

| Rod type |

Nameplate
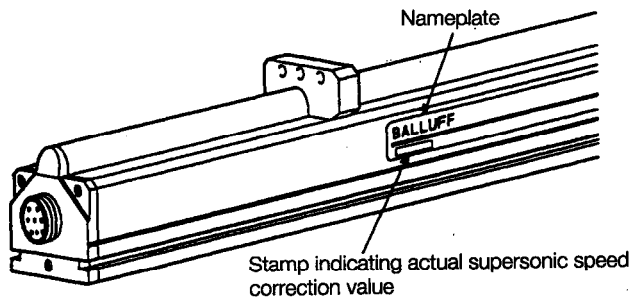
Stamp indicating actual supersonic speed
correction value
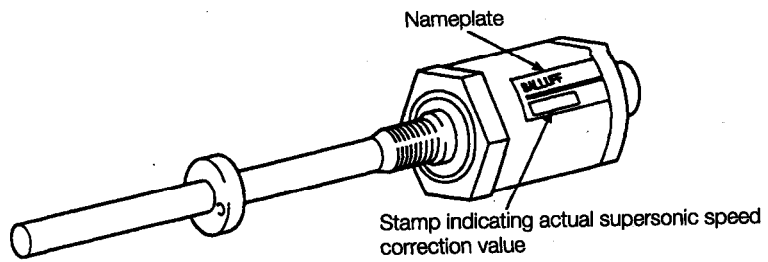
1.3 Orders and Consultation

To order the supersonic linear scale BTL, or to request further information, please contact one of the locations listed below.

Germany   ⓓ

World Headquarter
Gebhard Balluff GmbH & Co.
Gartenstraße 21-25
D-73765 Neuhausen/Filder
Postfach 11 60
D-73761 Neuhausen/Filder
Phone (0 71 58) 1 73-0
Fax (0 71 58) 50 10
Telex 7 23 392

Gebhard Balluff GmbH & Co. joints captitals to following 8 companies.

Austria   ⓐ

Gebhard Balluff GmbH & Co.
Niederlassung Österreich
Industriestraße B 16
A-2345 Brunn am Gebirge
Phone (0 22 36) 3 25 21-0
Telex 7 9166
Fax (0 22 36) 3 25 21 46

Brazil   ⒝ⓡ

BALLUFF CONTROLES
ÉLETRICOS ltda.
Avenida do Cursino, 2462
cep: 04132 - Jardim da Saúde
BR-Sao Paulo
Phone (011) 2 75 62 77
Telex 1 157 482
Fax (0 11) 5 78 68 55

Czech Republic   ⒞ⓩ

BALLUFF CZ, s.r.o.
Nad Ondřejovem 818/20
CZ-140 00 Praha 4
Phone / Fax
(02) 43 20 31, 43 60 23

Hungaria   ⓗ

Balluff Elektronika KFT
Marketing Iroda
Vihar u. 22
H-1221 Budapest
Phone (1) 2 26 23 95
Telex 2 25 740
Fax (1) 2 26 23 95

Japan   ⓙ

NIHON BALLUFF Comp., Ltd.
2491 Koya Ogawa-machi
Hiki-gun
J-Saitama, 355-03
Phone (04 93) 73 27 23
Fax (04 93) 74 49 59

Singapore   ⓢⓖⓟ

BALLUFF ASIA Pte. Ltd.
BLK 1004 Toa Payoh Ind. Park
Lorong 8, # 03-1489
SGP-Singapore 1231
Phone 2 52 43 84
Fax 2 52 90 60

Switzerland   ⒞ⓗ

BALLUFF Sensortechnik AG
Riedstr. 6
CH-8953 Dietikon
Phone (01) 7 40 87 20
Fax (01) 7 40 87 05

USA/Canada   ⓤⓢⓐ

BALLUFF Inc.
8125 Holton Drive
P.O.Box 937
USA-Florence,
Kentucky 4 10 42-0937
Phone (606) 727-2200
1-800-543-8390
Fax (606) 727-4823

Representatives

Argentine   ⓡⓐ

Nortecnica S.R.L.
Av. Francisco Beiro 4541
1419 Capital Federal
Argentina
Phone (01) 5 03 35 05
Fax (01) 5 03 41 32

Australia   ⓐⓤⓢ

Erwin Sick
Optik Electronic Pty. Ltd.
Heidelberg Road 899
AUS-Ivanhoe, Victoria 3079
Phone (03) 4 97 41 00
Fax (03) 4 97 11 87

Belgium   ⓑ

MULTITECHNIC n. v.
Leuvensesteenweg 262
B-1800 Vilvoorde
Phone (02) 2 52 14 50
Fax (02) 2 52 49 59

Bulgaria   ⒝ⓖ

Iwan Dotschowsky
Boul. Iskarsko Chaussée 12
BG-1592 Sofia
Phone (2) 79 30 01
Fax (2) 79 37 40

China   ⓟⓡⓒ

Balluff South China
Service Center
Dept. of Applied Physics
Shanghai Jiao Tong Univ.
Hua Shan Road 1954
PR-200030 Shanghai
Phone (0 21) 4 71 49 36
Fax (0 21) 4 71 49 36

Denmark   ⓓⓚ

Sick Optic-Electronic A/S
Datavej 52
DK-3460 Birkerød
Phone 45 82 64 00
Fax 45 82 64 01

Finland   ⓢⓕ

Murrelektronik Oy
Siltamäenkatu 35
SF-15300 Lahti
Phone (18) 7 56 41 88
Fax (18) 7 56 41 87

France ⓕ	Italy ①	Poland ⓟⓛ	Turkey ⓣⓡ
BALLUFF Automation 2 Rue du Vallon F-94440 Marolles en Brie Phone (1) 45 69 23 32 Fax (1) 45 99 22 99	Sick italiana S.p.A. Corso Giambone 63 I-10134 Torino Phone (011) 3 17 04 44 Telex 2 20 298 Fax (011) 3 17 01 40	ELTRON electronic s. c. ul. Szewska 3 PL-50-053 Wroclaw Phone (071) 44 25 32 Fax (071) 44 11 41	MEGA TEKNIK ELEKTRIK Okcumusa Menevse Han Cad. No. 54/144 TR-80020 Karaköy Istanbul Phone (02 12) 2 54 16 99 Fax (02 12) 2 54 53 19

Great Britain ⓖⓑ	Korea ⓡⓞⓚ	Portugal ⓟ	
MultiSwitch Balluff UK The Old Mill-Technical Studio Finney Lane GB-Cheadle, Cheshire SK 8 3 DQ Phone (01 61) 4 37 12 34/5/6 Fax (01 61) 4 36 14 35	Hankuk Sangsa Co. Sungjee Heights III Bldg. 3F. 642-6, Yuksam dong Kangnam-ku Seoul 135-080, Korea Phone (02) 5 64 96 92/3 Fax (02) 5 64 96 94	LA2P, Lda. Rua Amirante Sousa Dias, Loja D - Nova Oeiras P-2780 Oeiras Phone (11) 442 26 08, 442 26 58 Fax (11) 442 28 08	

Hong Kong ⓗⓚ	Croatia ⓒⓡⓞ	Sweden ⓢ	
CCL SYSTEMS FAR EAST LIMITED 14/F., Tai Po Comm. Centre, 152 Kwong Fuk Road, Tai Po, N.T., Hong Kong. Phone 6 56 63 23 Fax (852) 6 51 68 08	Elma-Femm Sime Devicica 6/4 Hrvatska CRO-41000 Zagreb Phone (0 41) 3 35-9 85 Fax (0 41) 3 35-9 85	BALLUFF Svenska Elektronik AB Per Håkanssons väg Industrihotellet Byggnad A, Port 8 S-24122 Eslöv Phone (04 13) 1 30 65 Fax (04 13) 1 06 89	

India ⓘⓝⓓ	Malaysia ⓜⓐⓛ	Spain ⓔ	
BALLUFF India 210, Arjun Centre Govandi Station Road Govandi, IND-Bombay 400 088 Phone (0 22) 5 56 80 97 Fax (0 22) 5 56 08 71	Sumber Engineering (M) SDN.BHD., No: 2 Lorong SS 13/6 A, Subang Jaya Indust. Estate MAL-47500 Petaling Jaya Selangor Phone (03) 53 42 27 Fax (03) 7 33 42 39	ELION S.A. Farell 5 E-08014 Barcelona Phone (03) 4 31 61 11 Telex 5 2 734 Fax (03) 4 31 18 00	

Indonesia ⓡⓘ	Mexico ⓜⓔⓧ	South Africa ⓩⓐ	
ELMECON Automatic Control Equipments II. Gajah Mada No. 218/i RI-Jakarta-Indonesia Phone (021) 63 01 36 Fax (021) 6 49 50 89	Freda S.A.de C.V. Apartado Postal No. 13 48, Col. Centro, Delg. Cuauhtémoc 5 de Mayo No. 32-413 MEX-06000 Mexico D.F. Phone (5) 5 21 21 85, 5 12 74 84, 5 21 11 09, 5 12 49 42, 5 21 62 80, Fax (5) 5 21-78 21 / 5 21-46 91	Retron cc P.O. Box 39448 ZA-Bramley, 2018 Phone (11) 7 86 05 53 Fax (11) 4 40 82 75	

Iran ⓘⓡ	Netherlands ⓝⓛ	Taiwan ⓡⓞⓒ	
Iran Technical Supply Co. 3rd Floor, No. 141 Sohrevardi Shomali Ave IR-Teheran Phone (021) 86 37 31 Fax (021) 86 95 37	Vierpool BV. Industrieweg 2 NL-3606 AS Maarssen Phone (0 34 65) 9 45 11 Telex 76 186 Fax (0 34 65) 7 40 55	Canaan Electric Corp. 6F-5, No. 63, Sec. 2 Chang An East Road Taipei, Taiwan, R.O.C. Phone (02) 5 08 23 31 Fax (02) 5 08 47 44	

Israel ⓘⓛ	Norway ⓝ	Thailand ⓣⓗⓐ	
Ancitech Ltd. 21, Haorgim St. Unit 21 Industrial Zone IL-Holon 58857 Phone (03) 5 56 83 51 Fax (03) 5 56 92 78	Sick Optic Electronic AS Baerumsveien 383 Postboks 160 N-1346 Gjettum Phone (0 67) 56 75 00 Fax (0 67) 56 66 10	Compomax Company Limited 9/17 Thana Arcade Ekamai Road (Sukhumvit 63) THA-10110 Bangkok Phone (02) 3 91-27 94 Fax (02) 3 81 17 10	

Appendix 2. External Dimensions

2.1 A64BTL Supersonic Linear Scale Interface Unit
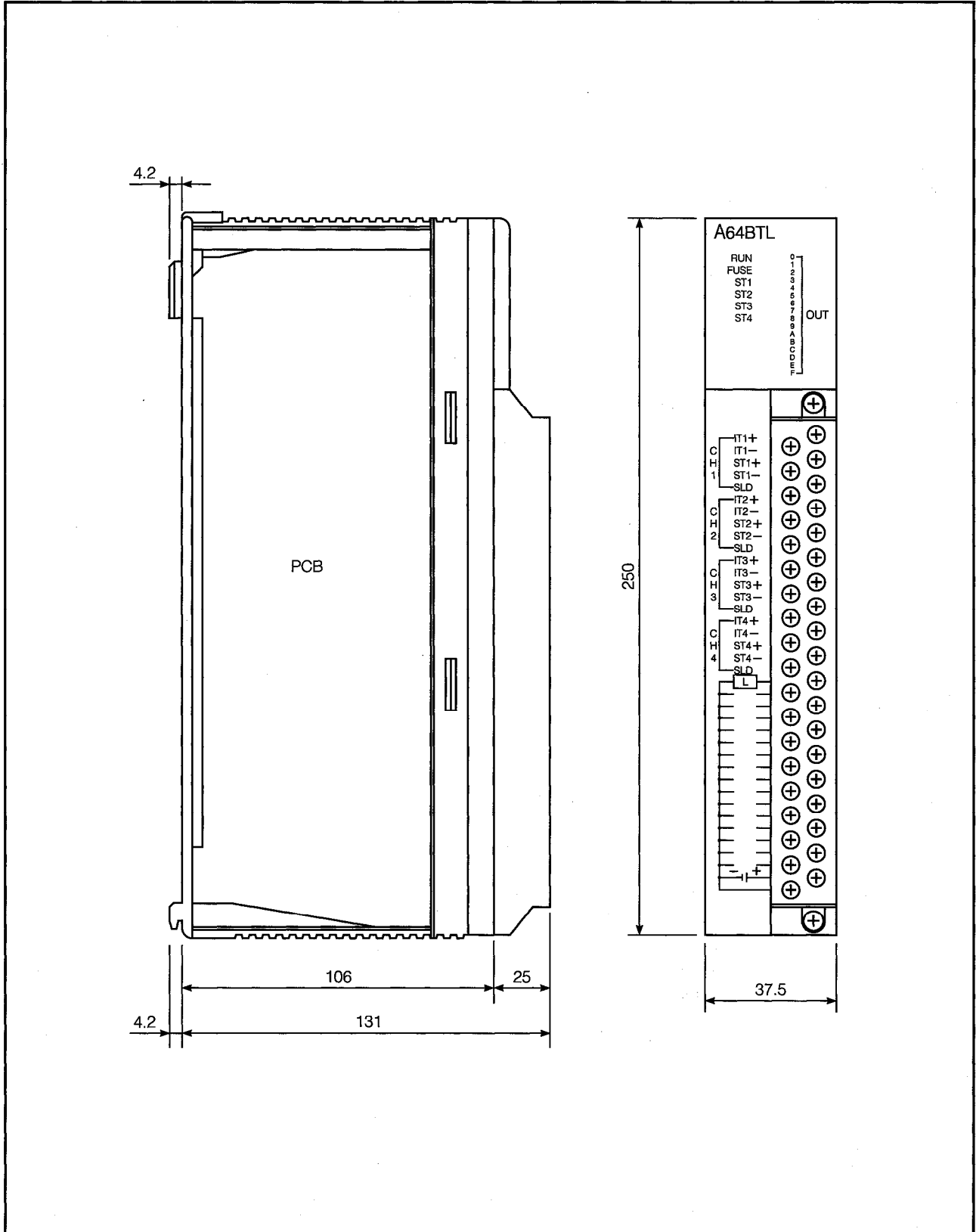
WARRANTY

Please confirm the following product warranty details before starting use.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the dealer or Mitsubishi Service Company. Note that if repairs are required at a site overseas, on a detached island or remote place, expenses to dispatch an engineer shall be charged for.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place.
Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.

1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not possible after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of chance loss and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to damages caused by any cause found not to be the responsibility of Mitsubishi, chance losses, lost profits incurred to the user by Failures of Mitsubishi products, damages and secondary damages caused from special reasons regardless of Mitsubishi's expectations, compensation for accidents, and compensation for damages to products other than Mitsubishi products and other duties.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

6. Product application

(1) In using the Mitsubishi MELSEC programmable logic controller, the usage conditions shall be that the application will not lead to a major accident even if any problem or fault should occur in the programmable logic controller device, and that backup and fail-safe functions are systematically provided outside of the device for any problem or fault.

(2) The Mitsubishi general-purpose programmable logic controller has been designed and manufactured for applications in general industries, etc. Thus, applications in which the public could be affected such as in nuclear power plants and other power plants operated by respective power companies, and applications in which a special quality assurance system is required, such as for Railway companies or National Defense purposes shall be excluded from the programmable logic controller applications.
Note that even with these applications, if the user approves that the application is to be limited and a special quality is not required, application shall be possible.
When considering use in aircraft, medical applications, railways, incineration and fuel devices, manned transport devices, equipment for recreation and amusement, and safety devices, in which human life or assets could be greatly affected and for which a particularly high reliability is required in terms of safety and control system, please consult with Mitsubishi and discuss the required specifications.

Supersonic Linear Scale Module Type A64BTL

User's Manual

MODEL	A64BTL-U-E
MODEL CODE	13J833
IB(NA)-66639-C(0312)MEE	

MITSUBISHI ELECTRIC CORPORATION

When exported from Japan, this manual does not require application to the Ministry of Economy, Trade and Industry for service transaction permission.

Specifications subject to change without notice.