OMRON
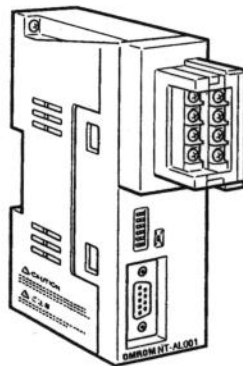
RS-232C/RS-422A Conversion Unit
NT-AL001

INSTRUCTION MANUAL

This Manual has important information on how the conversion unit is used. Please read through this manual thoroughly before using the unit. And after reading this manual, please keep this manual in a place where other users can easily find for future reference.

OMRON Corporation

1.   Characteristics

The RS-232C/RS-422A Conversion Unit NT-AL001, is used for connecting RS-232C connectors (on systems such as PTs,) to RS-422A connectors on other systems.

Please be sure that the user understands all the RS-232C and RS-422A specifications before using this unit.

It has the following characteristics;

Long distance data transmission is possible by using the RS-422A interface

The transmission specifications can be changed alternately from RS-232C to RS-422A, or from RS-422A to RS-232C, with the maximum data transmission length of 500 meters.

Power Supply-less

By applying a +5V(under 150mA) power from the RS-232C system to the No.6 pin on the RS-232C connector, the conversion unit will operate without the need of an outside power supply unit.

Duct Connection Possible

Since the RS-422A interface is a detachable terminal plate, it is easy to use in duct connections. Where as older D-SUB connectors were difficult to use (The RS-232C interface is a 9 pin D-SUB connector.)
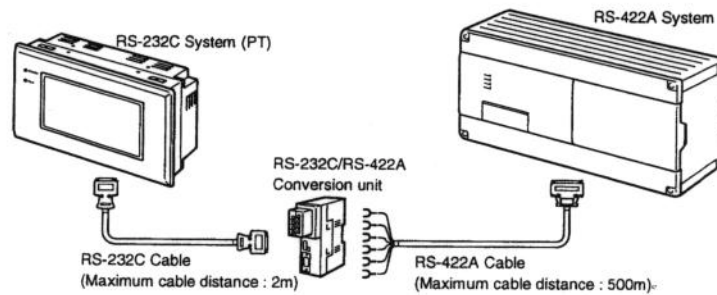
Small, Light Weight, Low Cost

Compared to our previous conversion unit, this new model is more small, light weight and low cost. Because of its upright figure, it is more easier to install and attach. And is also attachable to DIN rails.

2. System Configuration

As shown in the following diagram, the conversion unit is used to connect the RS-232C systems (such as PTs,) to RS-422A systems.

NOTE To assure that the +5V power from an RS-232C system does not drop lower than +5V, please make sure the distance of the RS-232C cable is shorter than 2 meters.

RS-232C cables will be used to connect RS-232C systems (such as PTs) to the conversion unit, and RS-422A cables will be used to connect RS-422A systems to the conversion unit.

RS-232C System (PT)

RS-422A System

RS-232C/RS-422A
Conversion unit

RS-232C Cable
(Maximum cable distance : 2m)

RS-422A Cable
(Maximum cable distance : 500m)

NOTE • When connecting the PT type described below as a RS-232C unit, prepare an external energizer (150mA min.) for supplying +5V separately.
NT600S-ST121(B)-V ☐

• Do not use this device in the following areas.
Places where there is water, oil, dust or steam.
Places where there is large change in temperature.
Places where there is high humidity causing condensation.
Places where there is strong magnetic fields.
Places where there is no air flow.
Places where there is strong shaking vibrations.

3. Dimensions

The following diagram shows the external dimensions of the conversion unit. Please use this as reference when installing the unit.
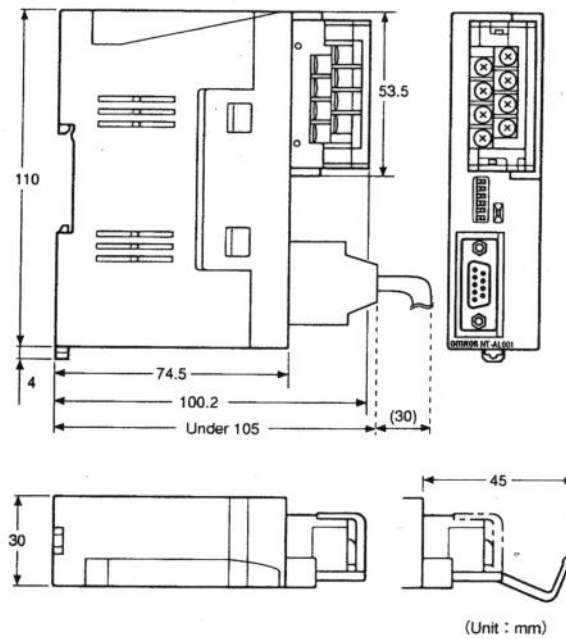
(Unit : mm)

30(W) × 114(H) × 100.2(D)mm   When the RS-422A Terminal Plate cover is closed

30(W) × 114(H) × 119.5(D)mm   When the RS-422A Terminal Plate cover is opened

4. Parts and Functions

The following diagram shows the parts and functions of the conversion unit, and explains their function.

RS-422A I/F Connection Terminal Plate
Connect the RS-422A cable.

DIP Switch for Setting
Specify the RS-422A transmission conditions.

POWER LED
The cable is connected, and if the correct power is supplied, the LED will turn ON.

RS-232C I/F connection connector
Connect the RS-232C cable that has a connector attached to it.

CAUTION
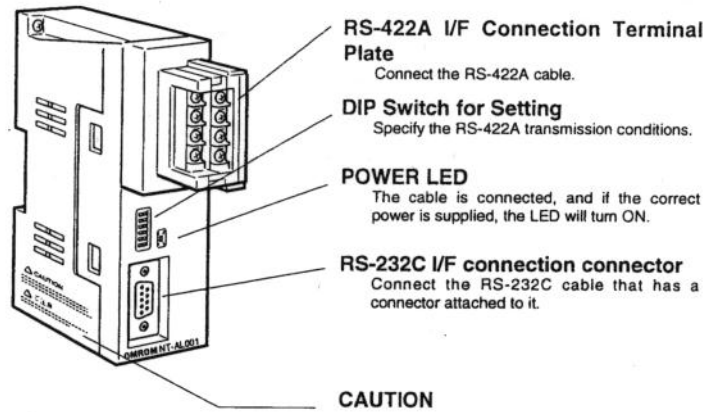
5. Pin Layout

The conversion unit has an RS-422A I/F connection terminal plate, and an RS-232C I/F connection connector. The RS-422A terminal plate and the RS-232C connector's pin layout are as follows.

RS-422A Terminal Plate
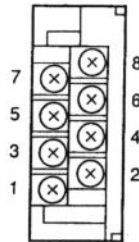
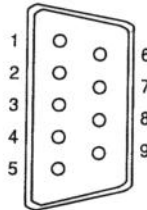| Terminal Plate Pin Number	Signal Name	Abbreviation	Signal Direction AL001 ⇔ RS-422A System
8	Request to Send (−)	CSA	→
7	Request to Send (+)	CSB	→
6	Send Data (−)	RDA	←
5	Receive Data (+)	RDB	←
4	Receive Data (−)	SDA	→
3	Send Data (+)	SDB	→
2	Signal Ground	SG(GND)	−
1	Frame Ground		−

※The CSB and CSA signals are used for specific systems.

RS-232C Connector

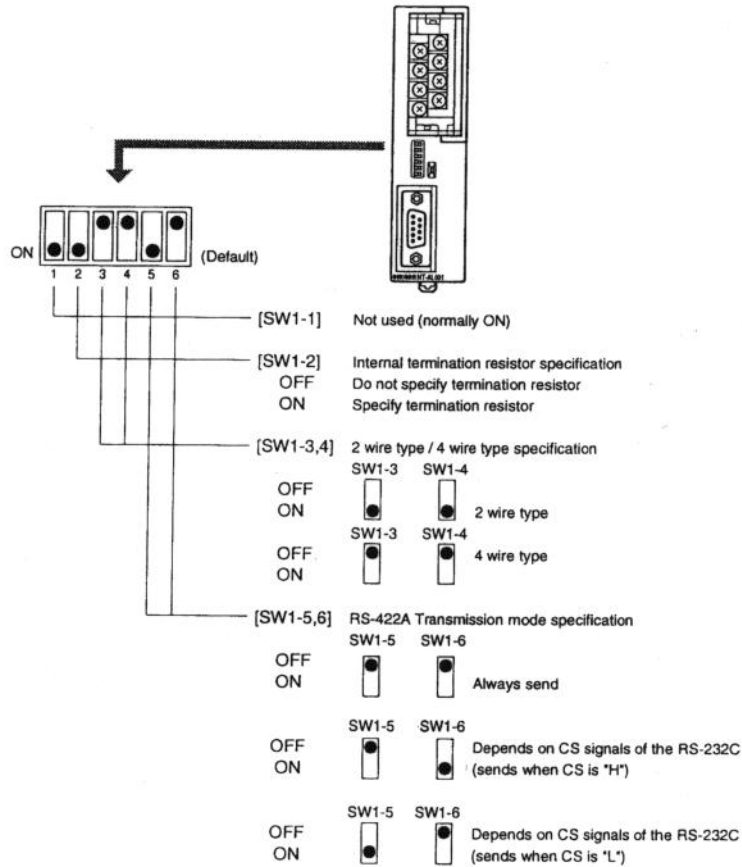| Connector Pin Number	Signal Name	Abbreviation	Signal Direction RS-232C System ⇔ AL001
1	Not Used	−	−
2	Send Data	SD(TXD)	←
3	Receive Data	RD(RXD)	→
4	Request to Send (internally connected with CS)	RS(RTS)	←
5	Clear to Send (Internally connected with RS)	CS(CTS)	→
6	+5V(150mA) for Conversion unit	+5V	→
7	Data set Ready (internally connected with ER)	DR(DSR)	→
8	Data Terminal Ready (internally connected with DR)	ER(DTR)	←
9	Signal Ground	SG(GND)	−

※The hood is connected to the Function Ground terminal of the RS-422A terminal plate.

6.　DIP Switch Specifications

The conversion unit has a 6 setting DIP switch for specifying the transmission conditions for the RS-422A.

Before connecting the cable to the conversion unit, set the DIP switch settings first.

The DIP switch on the conversion unit is for specifying the RS-422A transmission conditions.

[SW1-1]	Not used (normally ON)	
[SW1-2]	Internal termination resistor specification	
OFF	Do not specify termination resistor	
ON	Specify termination resistor	

[SW1-3,4]　2 wire type / 4 wire type specification

	SW1-3	SW1-4	
OFF			
ON	●	●	2 wire type

	SW1-3	SW1-4	
OFF			
ON	●	●	4 wire type

[SW1-5,6]　RS-422A Transmission mode specification

	SW1-5	SW1-6	
OFF			
ON	●	●	Always send

	SW1-5	SW1-6	
OFF			Depends on CS signals of the RS-232C
ON	●	●	(sends when CS is "H")

	SW1-5	SW1-6	
OFF		●	Depends on CS signals of the RS-232C
ON	●		(sends when CS is "L")

Set the dip switch as shown below for the system consisting of a host having the RS-232C interface and a PT (RS-422A/485).

- For the host or NT Link (1 : 1), set the RS-422A transmission mode to "transmission always" (sw1-5, 6 : Both OFF).
- For the NT Link (1 : N), set the RS-422A transmission mode to "conforming to RS-232C CS contrl" (sw1-5, 6 : Either ON).

NOTE
- Do not turn on SW1-5, and 6 at the same time.
- Be sure before turning the power of the RS-232C systems (such as PTs) "ON" (or applying power to the conversion unit,) that the cables are correctly connected, and the DIP switches are properly set.
  If the power is turned on when the cables are not correctly connected, the internal circuit may break.

Reference
Especially when connecting the Omron PLC C200HX/HG/HE/HW as the RS-422A equipment, make sure the SW1-5 and 6 switches are set as follows;

SW1-5 SW1-6
OFF   ON

5 6

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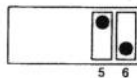
7.   Attaching or Detaching

The conversion unit can be attached to a DIN rail or the control panel.

Also, the conversion unit's RS-422A terminal plate can easily be detached.
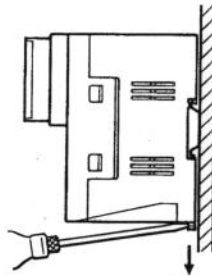
Attaching to the DIN Rail

Hook the back upper part of the conversion unit (part (a) of diagram) onto the top of the DIN rail, and then push towards (b).

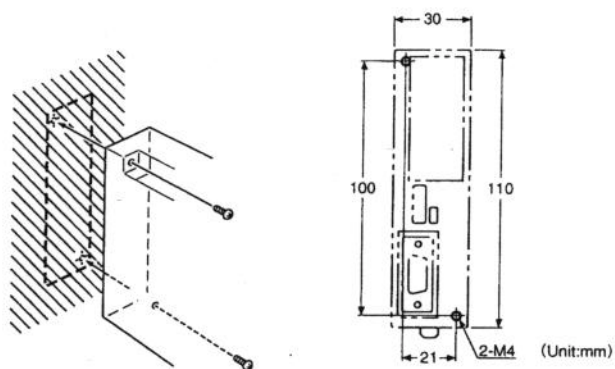Then attach the left and right end plates and secure the unit.
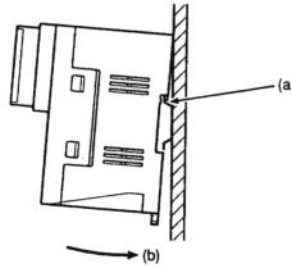
Detaching from the DIN Rail

Place a flat head screw driver into the back side of the conversion unit's rail stopper, and pull down the stopper. Then pull out the unit.

Attaching to the Control Panel

Open 2 holes into the control panel plate, which is thicker than 2mm, and then secure the conversion unit with screws.


```
                                    ← 30 →
                                   ┌─────────┐
                                   │ ○       │
                              100  │         │ 110
                                   │         │
                                   │  ○      │
                                   └─────────┘
                                    ← 21 →  2-M4   (Unit:mm)
```

NOTE To achieve the proper stability, the control panel plate must be thicker than 2mm.

Detaching the RS-422A Terminal Plate

Push apart the 2 levers on both sides of the RS-422A terminal plate (push in direction of arrows in diagram,) and then separate the RS-422A terminal plate from the conversion unit.
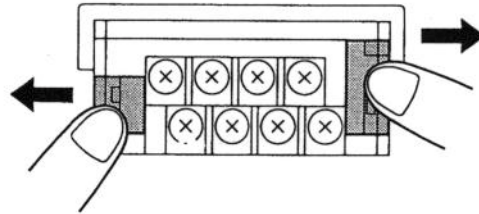
Attaching the RS-422A Terminal Plate

Push apart the 2 levers on both sides of the RS-422A terminal plate, and then push in the RS-422A terminal plate into the conversion unit.
After the insertion is done, the levers will return to their normal position, and make sure the plate is properly pushed in.

NOTE   When setting the RS-422A terminal plate, make sure the terminal contacts are clean. If the terminal contacts are not clean, transmission errors may occur. When attaching or detaching the terminal plate, make sure that the contact areas are clean.

Wiring of the RS-232C

RS-232C System (PT)　　　　　　　　　　　Conversion Unit RS-232C Connector

Abbreviation	Pin No.			Pin No.	Abbreviation	
FG	hood	Shielding Wire		hood		
SD	2			2	SD	
RD	3			3	RD	
RS	4			4	RS	RS-232C Interface
CS	5			5	CS	
+5V	6			6	+5V	
	7			7	DR	
	8			8	ER	
SG	9			9	SG	

(RS-232C Interface on left side)
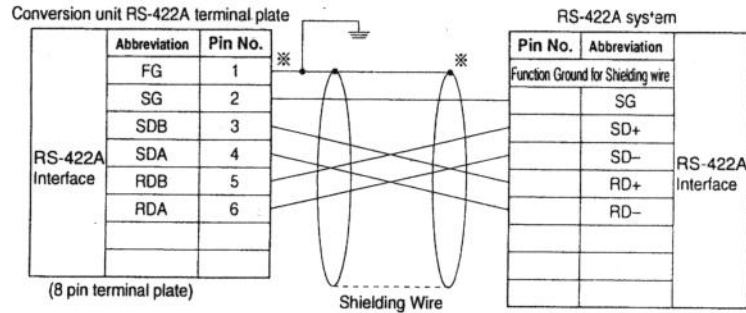
(9 Pin Type)　　　　　　　　　　　　　　　　(9 Pin Type)
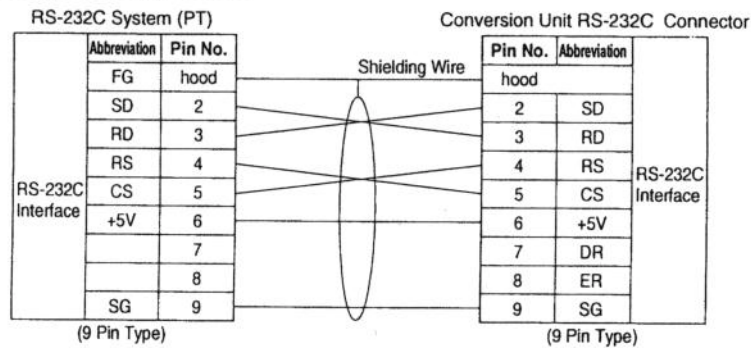
To assure that the No.6 pin (+5V) does not get miss-connected, the No.6 pin should be connected to an RS-232C system that is equipped with an over current protection circuit.

Unless supplying +5V from RS-232C unit, connect +5V power between No.6 and No.9 pins of a converter instead of connecting the RS-232C unit and the No.6 pin of the converter.

Compatible Recommendation	Type	Others
Connector (Plug)	XM2A-0901	9 pin type made by OMRON (or compatible)
Connector	XM2S-0911	9 pin type made by OMRON (or compatible)
Cable	AWG28 X 5P IFVV-SB	Multiple wire shield cable made by Fujikura Densen (or compatible)
	CO-MA-VV-SB 5P X 28AWG	Multiple wire shield cable made by Hitachi Densen (or compatible)
Cable Set	XW2Z-070T-1	9 pin - 9 pin (0.7m)
	XW2Z-200T-1	9 pin - 9 pin (2m)

NOTE　　Also, do not apply unspecified power the unit. The conversion unit may also break.

Wiring of the RS-422A

Conversion unit RS-422A terminal plate

Abbreviation	Pin No.
FG	1
SG	2
SDB	3
SDA	4
RDB	5
RDA	6

RS-422A Interface

(8 pin terminal plate)

RS-422A system

Pin No.	Abbreviation
Function Ground for Shielding wire	
	SG
	SD+
	SD−
	RD+
	RD−

RS-422A Interface

Shielding Wire

Make sure that the cables between SDB to SDA, RDB to RDA are all twisted pair cables.

※ To avoid malfunctioning due to grounding potential difference, ground the shieldedcable at only one end (conversion unit side or RS-422A device side).

Recommended Cables

Use the following shielded cables;

TKVVBS4P-03 (100m, Tachii Electric Wire),
or Shielded cables that complies AWG22.

Terminal Screws and Crimp Terminals

The terminal screws' specifications are M3(M3:A standard in Japan. M means metolic milimeter, and 3 meaning three. In this case a 3 mm diameter screw threaded in metolic dimension). When connecting, use crimp terminals for M3 terminals. Tighten the terminal screws with a torque of 0.5 N・m.

NOTE Do not connect shreded wire ends directry to the terminal.

Crimp Terminals

Please use crimp terminals with M3 holes.

Fork-type

Outer diameter under 6.2mm

Round-type

Outer diameter under 6.2mm
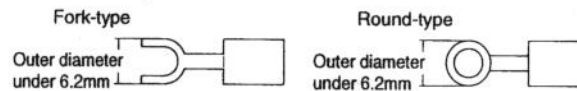
Applicable Crimp Terminals (Examples)

| Maker	Model	Applicable wire size
Molex	Y1.25-3.5L (Fork-type)	AWG22 to 18 (0.3 to 0.75mm²)
Nippon Crimp-Style Terminals	1.25-N3A (Fork-type)	

How to Ground the NT-AL001

On a system comprising extended connections using RS-422A connector cables, a large current may flow to the shield wire due to the potential difference between grounds if the shield wire is grounded at two or more point. For this reason, we recommend grounding at one point only on the RS-422A cable.

Also, noise tolerance is generally improved by grounding both ends of the RS-232C cable when a PLC is connected to peer device.

However, when these grounding methods are combined, a large current may flow and damage the devices if a system comprising extended connections using RS-422A connector cables is configured using an NT-AL001 (See Figure 2.)
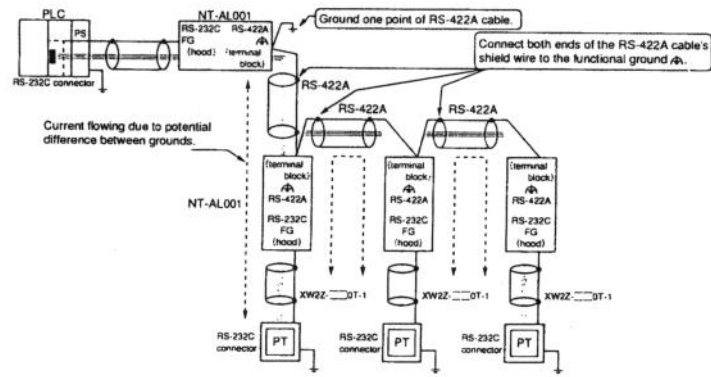
When grounding the NT-AL001, connect only one end of the RS-422A cable's shield wire to the functional ground terminal of the NT-AL001 as shown in Figure 1.

< Figure 1 Correct Wiring >
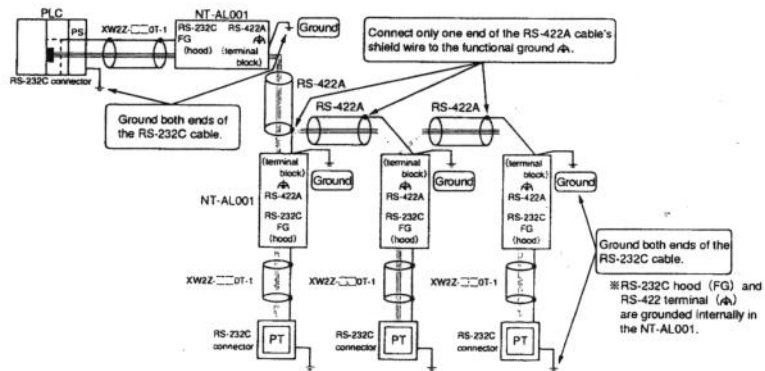
For details of how to connect your personal computer to a SYSMAC, contact the Engineering Dept.

< Figure 2 Incorrect Wiring >

9. Specifications

The next chart shows the basic specifications and the transmission specifications of the conversion unit.

Basic Specification

Item	Specification
External Dimension	30(W)×114(H)×100.2(D)mm
	When the RS-422A Terminal Plate cover is closed
	30(W)×114(H)×119.5(D)mm
	When the RS-422A Terminal Plate cover is opened
Weight	Under 200g
Usable Temperature	0 to 55℃
Usable Humidity	10 to 90%RH (Non condensing)
Specified Voltage Power	+5V±10% (RS-232C connector No.6 pin used)
Specified Current Power	Under 150mA
Instantaneous Current Surge	Under 0.8A
Insulation Resistor	Over 20MΩ (at DC 500V mega) between all signal lines from the RS-422A, and the functional ground terminals.
Anti-Voltage	Loak current under 10mA AC 1500V for 1 minutes, between all signal lines from the RS-422A, and the functional ground terminals.
Operating Environment	No corrosive gas in area
Storage Environment	−20 to +75℃
Anti-Vibration	Meats JIS C0911 standards, 60 minutes in X, Y & Z directions
Anti-Collision	Meats JIS C0912 standards, 147m/s^2 (3 times) in X, Y & Z directions

Transmission Specifications

RS-232C Interface

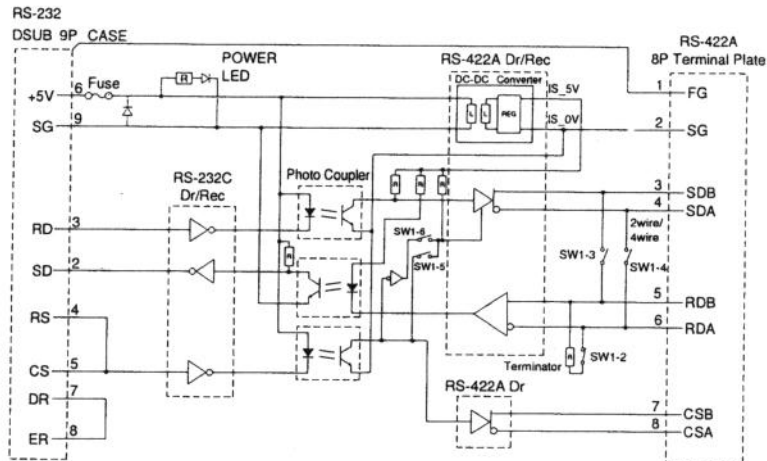| Items	Specifications
Transmission Rate	Maximum 64kbit/s
Transmission Distance	Maximum 2 meters
Connecter	9 pin D-SUB Connecter (Femail)

RS-422A Interface

Items	Specifications
Transmission Rate	Maximum 64kbit/s (depends on RS-232C Transmission rate)
Transmission Distance	Maximum 500 meters
Terminal Plate	8 Terminal Removable Plate M3.0

10. Block Diagram

The following diagram is an internal block diagram of the conversion unit. Please use this when making specific interfaces or when interfacing special systems to the unit.

RS-232
DSUB 9P CASE

POWER
LED

RS-422A Dr/Rec
DC-DC Converter

RS-422A
8P Terminal Plate

| +5V | 6 | Fuse | | IS_5V | 1 | FG |
| SG | 9 | | | IS_0V | 2 | SG |

RS-232C
Dr/Rec

Photo Coupler

RD	3				3	SDB
					4	SDA
SD	2		SW1-6	2wire/4wire		
			SW1-5	SW1-3	SW1-4	
RS	4				5	RDB
CS	5				6	RDA
DR	7		Terminator	SW1-2		
ER	8					

RS-422A Dr

| | | | | | 7 | CSB |
| | | | | | 8 | CSA |

11. Trouble Shooting

This section explains how to get over problems when the conversion unit does not work properly, or when the RS-232C systems (such as the PTs) do not communicate properly with the RS-422A systems.

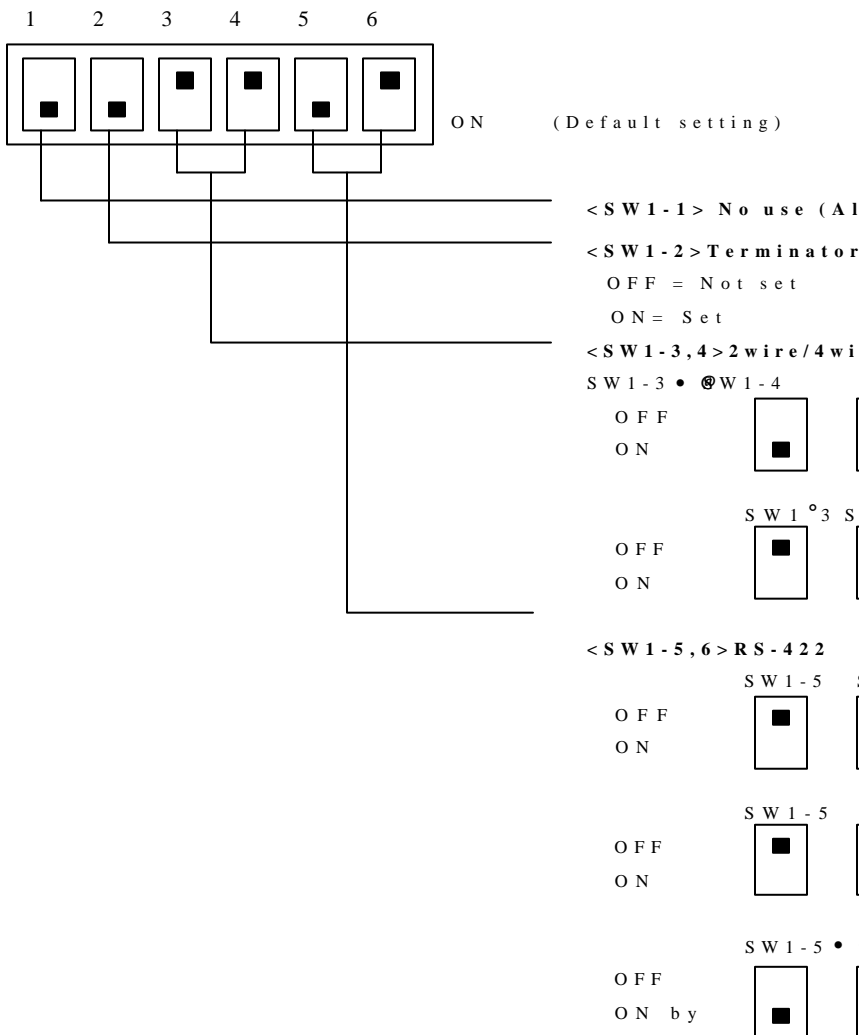| Trouble	Probable cause	Countermeasure
POWER LED does not turn ON.	+5V power is not supplied from the RS-232C cable.	Check the RS-232C connector cabling.
	The fuse is blown.	Call the maintenance service office.
Can't communicate	+5V power is not supplied from the RS-232C cable.or the +5V power is miss-connected.	Check the POWER LED, and make sure the power is supplied.
	The RS-422A signals polarity are opposite.	Check that the positive and negative polarities are connected to the proper pins.
	The setting of the DIP switch is not correct.	Check the DIPswitch setting.
	The RS-422A terminal plate is not fully pushed into it's slot.	Press in the RS-422A terminal plate, until a clicking sound is heard (set inside properly.)
	If the RS-422A specification is set to 2 wire type, the transmission mode is not set to "Depend on CS control of RS-232C"	Change the RS-422A transmission mode to "Depend on CS control of RS-232C" (SW1-5 or SW1-6 ON).
	In the RS-422A specification, the termination resistor is not specified.	The RS-422A system at the end need to have to the termination resistor spesified. Spesify the termination resistor by setting(SW1-2-ON).
	Noise on the transmission line.	Change the RS-422A transmission line to a twisted pair line. Also, make sure the lines are not parallel with the power line that may cause noise resistance, and use shiled lines.
	Uncorrect cable connections.	Set the DIP switch to the "2 wire type", and Send Data echoes back to Receive Data. By using a RS-232C device, be sure that Send Data is equal to Receive Data.

Topic : NT-AL001 specification; Signal converter 3G2A9-AL002(P)/3/4(P)/5(P)/6(P)/B500-AL007-P specification

<NT-AL001 specification>
1. RS232C(Dsub9)/RS422(Terminal), Max.=64 Kbps (RS232C max. length=2m, RS422 amx. length=500m)
2. RS/CS controlled (Default: Not controled by SW1-5)
3. 2 or 4 wire selection for RS422 (SW1-3,4=ON:2wire, Off:4wire)
4. Total delay < 1ms
5. Need to supply 5V+/-10% (Rated.150mA, Rush: 0.8A) by Pin 6 at RS232C NT20S and NT600S supports the power source.
SYSMAC C200H Alpha Comm. board and integrated RS232C port is also supported by pin 6.
6. Terminator 220 ohm selectable by SW1-2
7. Nomenclature: W30, H110, D100
8. Receiver IC=Max232CWE
9. MTBF=996K
10, RS232C not isolated, RS422 is isolated by DC/DC converter.
Notes: Products before 15Y5 does not specify 1:N communication. Pls set SW1-5,6 off.

Dip S/W setting:

```
      1     2     3     4     5     6

   ┌───┬───┬───┬───┬───┬───┐
   │ ■ │ ■ │■  │■  │ ■ │■  │
   │ ■ │ ■ │■  │■  │ ■ │■  │     O N     ( D e f a u l t  s e t t i n g )
   └───┴───┴───┴───┴───┴───┘
```

< S W 1 - 1 > N o u s e (A l

< S W 1 - 2 > T e r m i n a t o r
 O F F = N o t s e t
 O N = S e t

< S W 1 - 3 , 4 > 2 w i r e / 4 w i
S W 1 - 3 • ⓐW 1 - 4
 O F F
 O N   ■

             S W 1 °3 S
 O F F   ■
 O N

< S W 1 - 5 , 6 > R S - 4 2 2
             S W 1 - 5
 O F F   ■
 O N

             S W 1 - 5
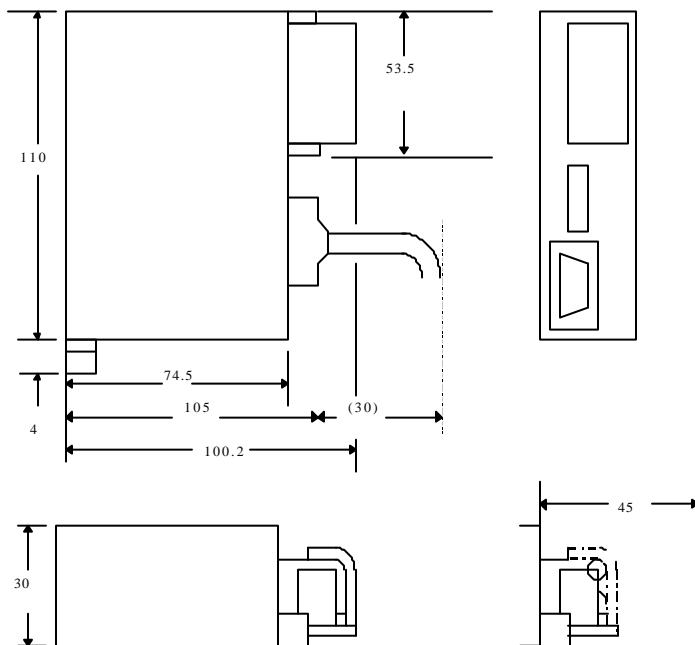 O F F   ■
 O N

             S W 1 - 5 •
 O F F
 O N   b y   ■

Note:1:N communication is possible since the Lot number
15Y5. CTS control is improved.
SW1-5,6 must not be turned on simultaniously. Otherwise

internal circuit may be damaged.
When C200HE/G/X is connected, please turn SW1-5 off,
SW1-6 On.

This unit is photo couppler isolated: Part of RS485 used in
NT-AL001: TDK HIM-7101.

No.of port   (): Total number
            APF (H-)PCF AGF RS-232C 422   485
Size(W,H,D)   Power
AL002-PE   (3)   (3)
178,101,63   100-110/200-240vac/12-24vdc
AL002-E   3   Ditto
Ditto

AL003-E			1	2	
200,120,55	100vac only				
AL004-PE	(1)	(1)	1	1	
188,120,63	110-120/220-240vac				
AL004-E	1		1	1	Ditto
Ditto					
AL005-PE	(1)	(1)	1		
178,110,63	100-110/200-240vac/12-24vdc				
AL005-E	1	1			Ditto
Ditto					
AL006-PE	(1)	(1)	2		
178,110,63	100-110/200-240vac/12-24vdc				
AL006-E	1	2			Ditto
Ditto					
AL007-P	(1)	(1)			1
165,100,63	100-110/200-240vac				