# MITSUBISHI
## MITSUBISHI MELTRAC-A SERIES INVERTER

## INSTRUCTION MANUAL FOR OPTION CARD T-OPT20

# INPUT/OUTPUT FUNCTION CARD
# T-OPT20

- PLG FEEDBACK CONTROL
- 16-BIT DIGITAL INPUT
- ADD-ON ANALOG OUTPUT
- RELAY OUTPUT
- 12-BIT A/D CONVERTER FOR FREQUENCY SIGNALS

Your purchase of this Mitsubishi MELTRAC-A Inverter Option Card is greatly appreciated.
This instruction manual describes operating instructions and cautionary notes to use your MELTRAC-A Option Card correctly.
Incorrect operation or handling may cause unexpected problems. Be sure to read this instruction manual thoroughly so that you will use your Option Card correctly.

INPUT/OUTPUT FUNCTION CARD (T-OPT20)
This is a multi-functional option card intended to be used on industrial machines. The Option Card has the following functions.

- PLG Feedback control
- 16-bit digital input
- Add-on analog output
- Relay output
- 12-bit A/D converter for frequency signals

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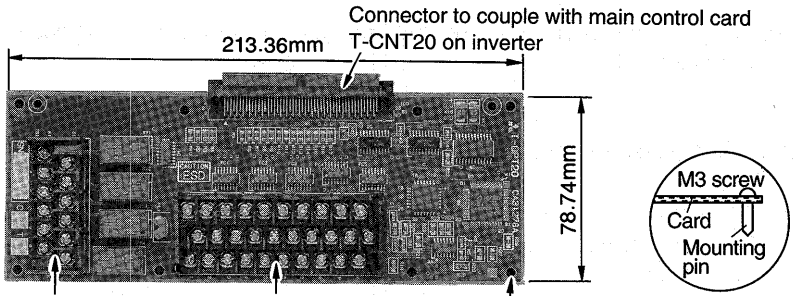
# 1. OUTLINE




- Relay output (4 points)
- PLG feedback control
- 16-bit digital input

## Terminal block TB1 Terminal layout

| No. | Signal name | Description | No. | Signal name | Description |
|---|---|---|---|---|---|
| D1 | RC1 | Relay 1 common terminal | E1 | RA1 | Relay 1 output terminal (normally OFF) |
| D2 | RA1 | Relay 2 output terminal (normally OFF) | E2 | RB1 | Relay 1 output (normally ON) |
| D3 | RB2 | Relay 2 output (normally ON) | E3 | RC2 | Relay 2 common terminal |
| D4 | RC3 | Relay 3 common terminal | E4 | RA3 | Relay 3 output terminal (normally OFF) |
| D5 | RA4 | Relay 4 output terminal (normally OFF) | E5 | RB3 | Relay 3 output (normally ON) |
| D6 | RB4 | Relay 4 output (normally ON) | E6 | RC4 | Relay 4 common terminal |

## Terminal block TB2 Terminal layout

| No. | Signal name | Description | No. | Signal name | Description | No. | Signal name | Description |
|---|---|---|---|---|---|---|---|---|
| A1 | I0 | DI data 0 | B1 | I1 | DI data 1 | C1 | I2 | DI data 2 |
| A2 | I3 | DI data 3 | B2 | I4 | DI data 4 | C2 | I5 | DI data 5 |
| A3 | I6 | DI data 6 | B3 | I7 | DI data 7 | C3 | I8 | DI data 8 |
| A4 | I9 | DI data 9 | B4 | I10 | DI data 10 | C4 | I11 | DI data 11 |
| A5 | I12 | DI data 12 | B5 | I13 | DI data 13 | C5 | I14 | DI data 14 |
| A6 | I15 | DI data 15 | B6 | DY | DI data DY | C6 | PC | 24 V input for DI |
| A7 | | NC (connection) | B7 | | NC (connection) | C7 | SD | 24 V for DI GND |
| A8 | LM1 | Analog current output | B8 | 12V | PLG 12 V return | C8 | SG | PLG GND return |
| A9 | LM0 | Analog voltage output | B9 | PB1 | PLG phase B + | C9 | PA1 | PLG phase A + |
| A10 | LM2 | Analog GND common | B10 | PB2 | PLG phase B – | C10 | PA2 | PLG phase A – |

# 2. INSTALLATION

Remove the front cover from the inverter. Mount the Option Card according to the following instructions.

## 2-1 PREPARATION FOR INSTALLATION

(1) Check that the inverter type and model number are correct.
This Option Card is exclusively for MELTRAC-A series products and is not applicable for other series.

(2) Check that the main circuit power and the control circuit power of the inverter have been turned off.
Do not mount the Option Card while power is on, as doing so would cause the inverter to fail.

(3) If the PLG feedback control (optional) is to be used, prepare a PLG (or a motor with a PLG) and external power source.
See page 9 for details.

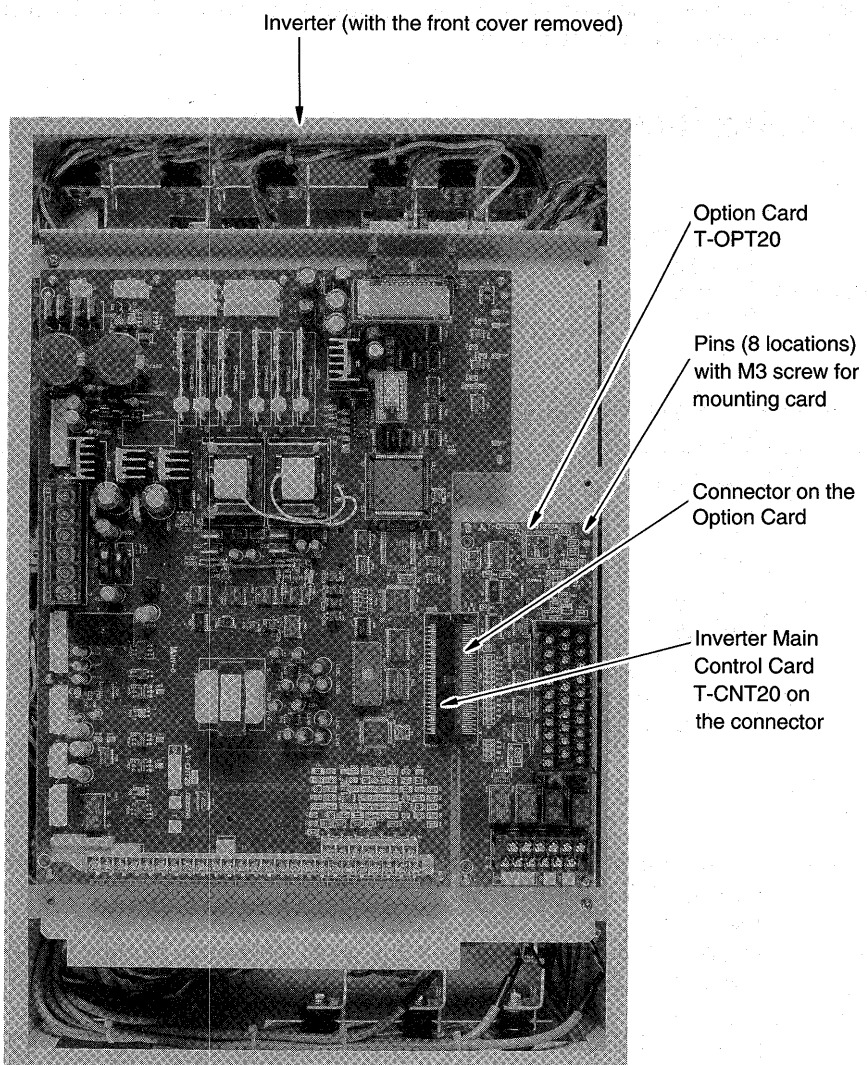
(4) Check that the following items are in the package.
- Operation manual x 1
- Option Card T-OPT20 x 1
- Jumper piece (a piece secured on terminal x 1
- M3 screws for mounting Option Card x 8
- Stand-offs for mounting Option Card x 8

## 2-2 INSTALLATION PROCEDURE

(1) Insert the Option Card connector into the connector on the main control card of the inverter.
Be sure to insert it firmly until fully seated.

(2) Securely mount the Option Card on the inverter with the attached M3 screws (8 locations). The connector may be incorrectly coupled if the stand-offs are not properly aligned with the inverter.

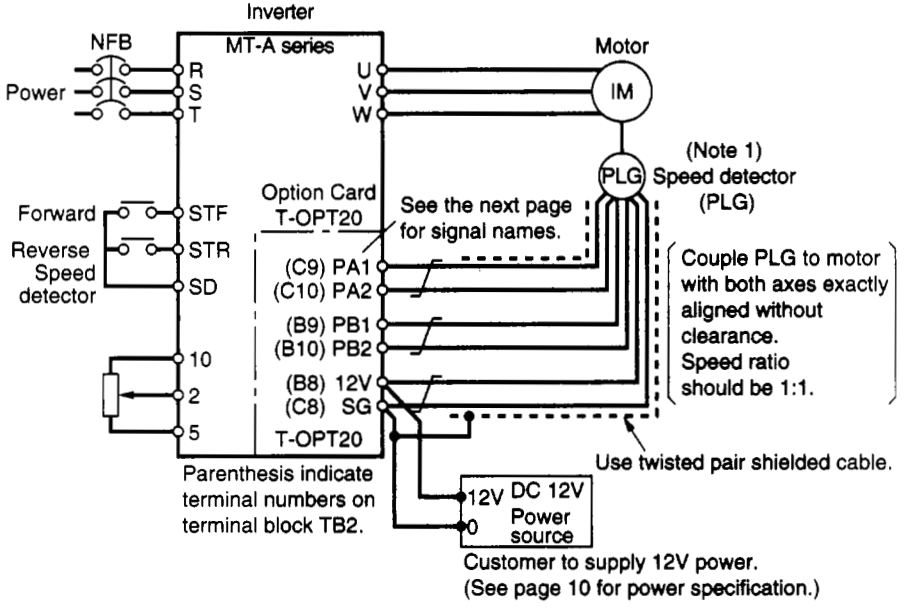
(3) See page 3 for mounting instruction.


Inverter (with the front cover removed)
Option Card
T-OPT20
Pins (8 locations)
with M3 screw for
mounting card
Connector on the
Option Card
Inverter Main
Control Card
T-CNT20 on
the connector

# 3. OPERATING INSTRUCTIONS FOR PLG FEEDBACK CONTROL FUNCTION

A speed detector (pulse encoder PLG) detects motor rotational speed. The speed is fed back to the inverter which controls the output frequency in order to maintain a constant motor speed regardless of load variation.

## 3-1 CONNECTION DIAGRAM

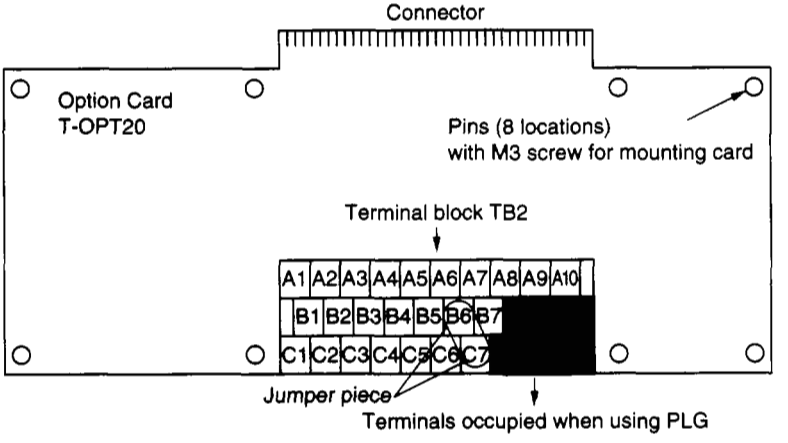



Note 1 The number of PLG pulses depends on the number of poles of the motor.
Number of PLG pulses = 150 pulses / number of poles
Example:
Install a 300 pulse-per-revolution PLG for a 2-pole motor or a 600 pulse-per-revolution PLG for a 4-pole motor.

| Motor | Pulse number of PLG |
|---|---|
| 2 Poles Motor | 300 Pulses per revolution |
| 4 Poles Motor | 600 Pulses per revolution |
| 6 Poles Motor | 900 Pulses per revolution |
| 8 Poles Motor | 1200 Pulses per revolution |

## 3-2 TERMINAL DESCRIPTION

| Terminal No. | Signal name | Terminal name | Rating, etc. | Description |
|---|---|---|---|---|
| C9 | PA1 | PLG signal 1 *(phase A +) terminal* | See page 9 for details of pulse signals. | Receives phase A and phase B signals from encoder. |
| C10 | PA2 | Common (PLG phase A –) | | |
| B9 | PB1 | PLG signal 2 (phase B +) terminal | | |
| B10 | PB2 | Common (PLG phase B –) | | |
| B8 | 12V | Positive power input terminal | DC 11.4 to 12.6 V (current consumption 200 mA) | Connect PLG power input.<br>Connect 12 V + to terminal B8.<br>Connect ground (SG) to terminal C8.<br>Connect shielding line of shielded cable to terminal C8. |
| C8 | SG | Power ground terminal | | |

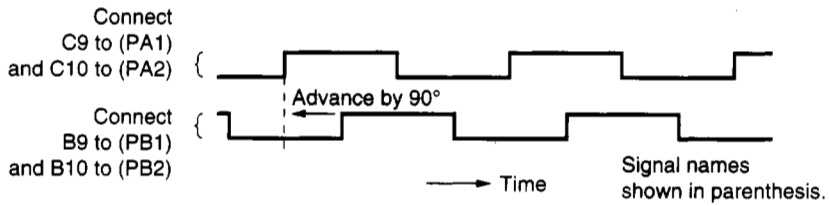


## 3-3 CAUTIONARY NOTES ON WIRING

(1) Wiring to speed detector (PLG)
Use a twisted pair shielded cable (not smaller than 16 AWG (1.25 mm$^2$)) for wiring to the Option Card (T-OPT20). The wiring to terminal B8 (12 V) and the wiring of the shield line of the twisted pair shielded cable to terminal C8 (SG) should be as follows depending on the length of the wiring.

| Length of wiring | Increase in size |
|---|---|
| No longer than 100 m | No smaller than 16 AWG (1.25 mm$^2$) |
| No longer than 200 m | No smaller than 14 AWG (2.00 mm$^2$) |

※ For the T-OPT20 terminals (C9, C10, B9 and B10), connect the feedback signal which has a phase angle that advances by 90° to terminals C9 and C10 when the motor rotates in the forward direction.




## 3-4 ADJUSTMENT

(1) Parameters
Before operating the inverter, set the following parameters.

**Table of parameters**

| Function No. | Function | Range of setting | Minimum setting | Ex-factory setting | Note |
|---|---|---|---|---|---|
| 37 | Number of motor poles | 2 – 10※<br>11 – 9998 | 1 | 4 | See page 7. |
| 105 | Range of speed feedback | 0.01 –<br>400 Hz<br>9999 | 0.01 Hz | 9999 | Speed feedback does not occur if set to 0 or 9999. |
| 106 | Feedback gain | 0 – 100 | 0.1 | 1 | See page 8. |

(2) Setting number of motor poles (Pr.37)

Set the number of poles of the motor used.

※ Option Error (E.OPT) occurs if the inverter is operated with this parameter set to 11 – 9998.

Resetting: Set the number of motor poles to the correct value. Reset the inverter.

(3) Setting speed feedback range (Pr.105)

Set the range in which the feedback control takes place.

Set the upper and lower values based on the target value i.e. the frequency at which the user desires the motor to operate reliably.

Set this parameter by converting the slip (rpm) of the motor at its rated speed and load to a frequency.

(Example) Assume that the rated speed of a 4-pole motor is 1,740 rpm at 60 Hz.

Slip Nsp = synchronous speed – rated speed

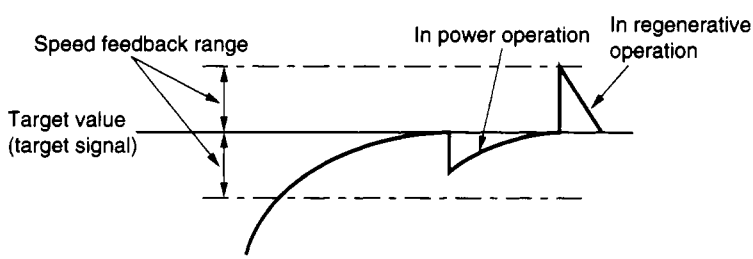
= 1,800 – 1,770 = 30 (rpm)

Frequency fsp corresponding to the slip

fsp = (Nsp x number of poles)/120

= (30 x 4)/120 = 1 (Hz)

Poor response will result if the feedback range is too wide.




※ The speed feedback is set to 9999 (speed feedback not available) at the factory. Before starting operation, be sure to set this parameter to the proper value.

(4) Setting feedback gain (Pr.106)
Set this parameter if the rotation is unstable or response is poor.
Setting greater than 1 ..... Response is improved. Unstable operation or over-current tends to occur.
Setting less than 1 ..... Response becomes slow. Stable operation results.

## 3-5 CAUTIONARY NOTES ON PLG FEEDBACK CONTROL

(1) Incorrect number of poles of the motor results in operation or control at incorrect speeds.

(2) The PLG should be coupled to the motor with its axis aligned exactly in line with the motor axis. The speed ratio should be 1:1.

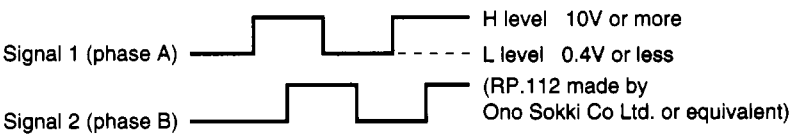
(3) To avoid instable phenomena such as hunting, feedback control does not take place during acceleration or deceleration.
Feedback control takes place once the output frequency reaches within (set speed) ± (speed feedback range).

(4) If any of the following situations occur during a speed feedback operation, the inverter will not stop operation or produce an alarm. The inverter produces a frequency of (set speed) ± (speed feed-back range) and does not follow the motor speed.
- The pulse encoder stops generating pulse signals due to failure such as electrical discontinuity.
- Pulse signals cannot be detected correctly due to interference such as induction noise.
- The motor is forced to accelerate (regenerative operation) or decelerate (such as motor locking) due to a large external force.

## 3-6 SPECIFICATIONS

(1) Drive motor
Standard motor 2-, 4-, 6-, or 8-pole
Constant torque motor 2-, 4-, 6-, or 8-pole

(2) Speed detector (PLG)




PLG output signal terminal numbers (Ono Sokki RP.112)

| Terminal No. | Description |
|---|---|
| 1 | Signal 1 (phase A) |
| 2 | Common |
| 3 | Signal 2 (phase B) |
| 4 | Common |
| 6 | Case (shield) |
| 7 | 12V |
| 8 | 0V |

(3) Speed variation
Within ±0.1 % of the maximum speed (3600 rpm)
(Load variation※ 0 – 100 %) ..... 6 Hz or more)
※ 100% load means the maximum continuous operating torque with respect to the operating frequency that depends on the motor output characteristics. See the catalog or technical data.

(4) Speed control range
The speed control range depends on the inverter.

(5) Setting
- Setting speed feedback range
- Setting feedback gain

(6) Power source

The PLG and Option Card need a DC 12 V power source.
The customer should prepare this power source as it is not within the system supplied.

Power source: DC 12 V
No less than 200 mA current carrying capacity
For PLG–approximately 150 mA for normal operation
For Option Card–50 mA

## 3-7 CAUTIONARY NOTES ON USING PLG

The PLG consists of precision parts and components.
Handle and operate the PLG with care. It may not function correctly if given a shock.

(1) Installation

- When installing the PLG do not subject it to shock by hammering it or exerting excessive force on the shaft.
- Use a coupling to connect the encoder shaft and the equipment shaft.
  Do not apply excessive forces when installing the coupling on the shaft.
  An improperly installed coupling may cause the shafts to receive a force larger than that allowed. Make sure that the shafts are correctly aligned and centered.
- Bearing life depends on the conditions of use, especially on the shaft load. Note that longer bearing life can be expected under lower shaft loads.
- Do not disassemble the PLG, otherwise the oil sealing and drip proof capability may be impaired. Although the PLG is drip proof, make sure that it is not exposed to water or oil for a long period. Wipe off water or oil if splashed.

(2) Vibration

- Vibration may cause the PLG to generate incorrect pulses. Make sure that the PLG is installed in a location free from the influence of vibration.
  The clearance between the slits of rotating slit disc is small for PLGs that generate many pulses per revolution. Such PLGs are sensitive to vibration. During low speed operation or when stopped, vibration may cause the PLG to act as if the rotating slit disc had moved, making it generate incorrect pulses.

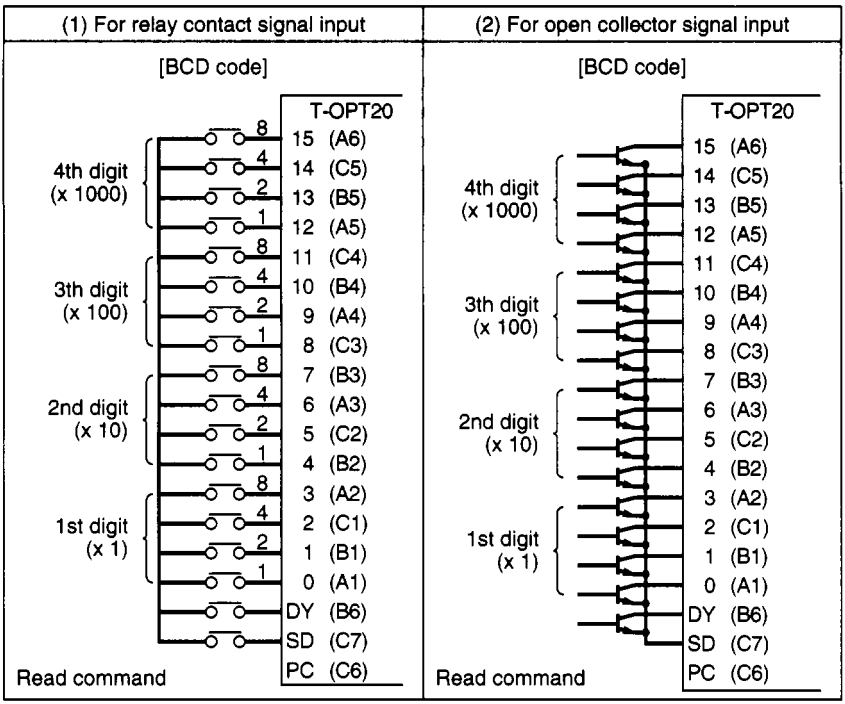
(3) Electrical wiring and connection
Make sure that the electrical wiring and connections are correct. Otherwise, the internal circuits will be damaged.

(4) Counter-measures against noise
- Do not install the cables in parallel to power lines or in the same wiring duct.
- Do not use the PLG near discharge welding equipment or an electric furnace or similar equipment. In this case provide the cables with magnetic shield.
- Be sure to use shielded cables for extension wiring.
- Incorrect pulses may be generated when turning on or off the power. Wait a few seconds after turning on or off the power, before use.
- If malfunction due to noise caused by electrical potential between the PLG and control panel enclosures is possible, connect the two enclosures with wires no smaller than 2.0 $mm^2$ (14AWG).

# 4. 16-BIT DIGITAL INPUT

External BCD or binary digital signals can be used to set frequencies.

## 4-1 EXAMPLES OF WIRING




Parenthesis show terminal numbers on terminal block TB2.

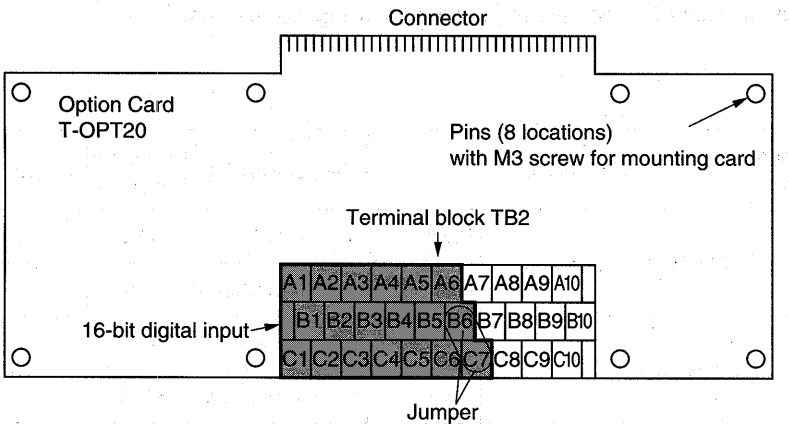
Note 1 When using relay contacts, use relays for opening/closing micro-electric currents.

2 For the open collector signal input system, use transistors of the following specifications.

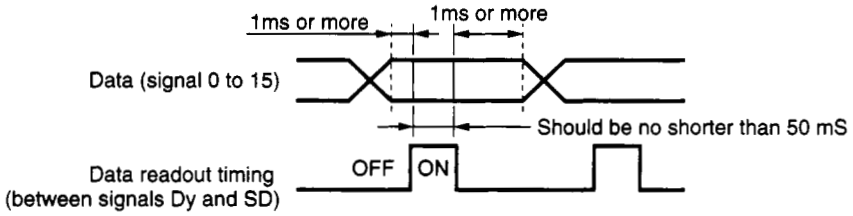
- Ic ≥ 100 mA
- Leakage current no greater than 100 μA
- $V_{CE}$ ≥ 50 V
- Limit the base current so that voltage $V_{CE}$ is no greater than 2 V when Ic is 10 mA.

## 4-2 DESCRIPTION OF TERMINALS

| Terminal | Signal name | Description |
|---|---|---|
| A1 – A6<br>B1 – B5<br>C1 – C5 | 0 – 15 | Digital signal input terminals (terminals for frequency setting signals)<br>Use these signals to enter four-digit BCD codes (up to 9999) or 16-bit binary signals (up to FFFFH) through relay contact or open collector system. |
| B6 | DY* | Input signal for timing data readout.<br>Use this signal as a timing signal to provide inverter with digital signals.<br>Data can be read only when terminals DY and SD are strapped. If a connection between terminals Dy and SD is opened, data before opening is retained. |
| C7 | SD | Common terminal<br>Common terminal for digital input signals and signal for timing data readout. 24 V GND |
| C6 | PC | External common transistor<br>When connecting transistor output signals (open collector signals) such as from programmable logic controller (PLC), connect positive common terminal of external power source to this terminal to avoid malfunction due to sneak currents. 24 V input |



★ Terminal usage (DY)




The inverter does not read frequency data if the connection between terminals B6 (DY) and C7 (SD) is open.
This means that, although signal 0 to 15 varies the frequency data established before opening, the connection between signals DY and SD remains valid. Terminals between B6 (DY) and C7 (SD) are shorted with a jumper before delivery from the factory. Before using terminal B6 (DY), remove the jumper.

## 4-3 ADJUSTMENT

(1) Parameters
Before operating the inverter, set the following parameters.

| Function No. | Function | | Range of setting | Ex-factory setting | Note |
|---|---|---|---|---|---|
| 100 | BCD input | Bias | 0 – 400 Hz | 0 Hz | |
| 101 | | Gain | 0 – 400 Hz, 9999 | 60 Hz | |
| 102 | Binary input | Bias | 0 – 400 Hz | 0 Hz | |
| 103 | | Gain | 0 – 400 Hz, 9999 | 60 Hz | |
| 104 | Selection of digital input and availability of analog compensation input | | 0, 1, 2, 3, 9999 | 9999 | |

(2) Input selection (Pr.104)

Parameter 104 allows the operator to select the type of digital input signals and availability of analog compensation for digital input signals.

| Type of digital input signals | Analog compensation input | |
|---|---|---|
| | Compensation available | Compensation not available |
| BCD input | 0 | 2 |
| Binary input | 1 | 3 |

※ Analog compensation input signals are connected between terminals 1 and 5. Analog signals are not accepted if set to "0" or "1."
If set to "9999" (factory setting), digital input is not used.

(3) Bias adjustment (Pr.100 and Pr.102)

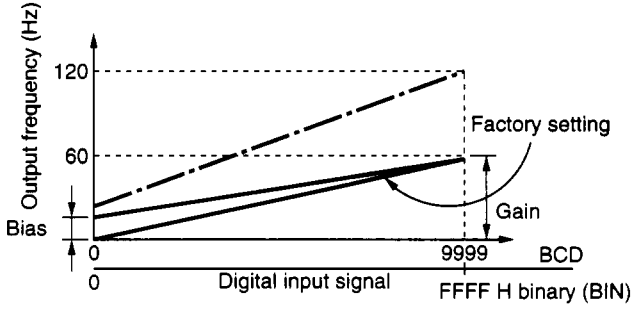
These parameters provide bias and gain adjustment over digital input signals. The output frequency should be set when digital input is 0. If primary magnetic flux control has been selected then frequent should be set.

- BCD input ..... Use parameter 100.
- Binary input..... Use parameter 102.

(4) Gain adjustment (Pr.101 and Pr.103)

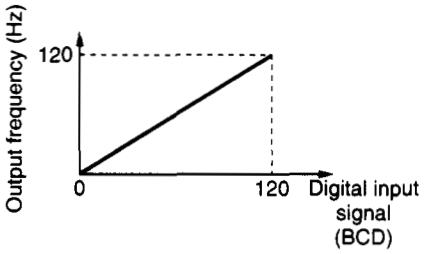
Two methods are available for setting gain magnitudes as shown below.

※ Gain adjustment method by setting output frequency with input signal being "9999" (for BCD codes) or FFFFH (for binary)
(The inverter is factory-set to 60 Hz with this input signal.)



Note: When adjusting the bias and gain, output frequencies with digital signals of "0" and "9999 (or FFFFH)" are employed, respectively, whether or not digital input signals exist.

- Gain adjustment method when a BCD code or binary value is used as the setting.
  If parameter 101 (for BCD input) or parameter 103 (for binary input) is set to "9999," the digital input value is directly used as the output frequency setting.
  Example: To set output frequency to 120 Hz when BCD input is 120.




Note: If this method is used, bias setting (parameters 100 and 102) is not available.

(5) Maximum output frequency
The gain setting described in (4) above is used as the maximum output frequency when digital input signals are used to operate the inverter.
If the maximum output frequency is to be 60 Hz or higher, change the gain setting through the parameter unit.

(6) Acceleration/deceleration time
Like the analog signal input system, when the frequency is established by digital input signals, the time necessary to reach the parameter 20 value (acceleration/deceleration reference frequency) is used as the acceleration/deceleration time.

## 4-4 CAUTIONARY NOTES

(1) Digital input signals are subjected to the following restrictions.
- If the digital signals are used as BCD input, input signals into 0AH through 0FH in each line are ignored when the inverter is in operation. Therefore, the inverter continues to operate according to the input signals having been established before the above data entry into 0AH through 0FH.

(2) This Option Card is exclusive for MELTRAC-A series products and is not applicable for other series.

(3) With the digital input card T-OPT20 installed, the functions of the MELTRAC-A inverter and the usage of its terminals are as listed in the following table.

**Usage of inverter terminals**

| Terminal symbol | Terminal name | Validity of inverter terminal |
|---|---|---|
| STF | Operation in normal direction | Valid |
| STR | Operation in reverse direction | Valid |
| STOP | Terminal for selecting holding during start-up | Valid |
| RH, RM, RL | Multi-speed selection terminal | *Invalid (Speed setting is available but not operative.) |
| JOG/OH | JOG mode selection terminal or external thermal input terminal | Valid |
| RT | Secondary acceleration/deceleration time selection terminal | Valid |
| MRS | Inverter output halt terminal | Valid |
| RES | Reset terminal | Valid |
| AU | Current input selection terminal | *Invalid |
| CS | Re-start selection terminal after instantaneous power failure | Valid (only if Pr.57 is not 9999.) |
| 2 | Frequency setting (voltage signal) terminal | *Invalid |
| 1 | Frequency setting auxiliary input (±5 V or ±10 V) terminal | *Valid if Pr.104 is set to "2" or "3." |
| 4 | Frequency setting (current signal) terminal | *Invalid |

"Invalid" if accompanied by symbol "*" becomes valid if parameter Pr.104 is set to 9999.

(4) With the T-OPT20 Option Card installed, inverter terminal 1 may receive 0 to 5 V (or 0 to 10 V) signals from an external potentiometer. In this situation, the inverter will operate at a frequency which is the sum of the BCD input from the T-OPT20 Option Card and the auxiliary input through terminal 1 provided that parameter 104 is set to "2" or "3." BCD input signals and auxiliary input signals may be used separately. For example, inverter may be operated manually with signals from a potentiometer or operated automatically with BCD signals. In such cases, set the BCD input signals during manual operation to "0."

(5) If used with BCD input signals, data cannot be entered to addresses 0AH through 0FH in each line.
Even if data enters into 0AH through 0FH during operation, such data entry is ignored. The inverter therefore continues to operate at the frequency having been established before the above data entry.

## 4-5 SPECIFICATIONS

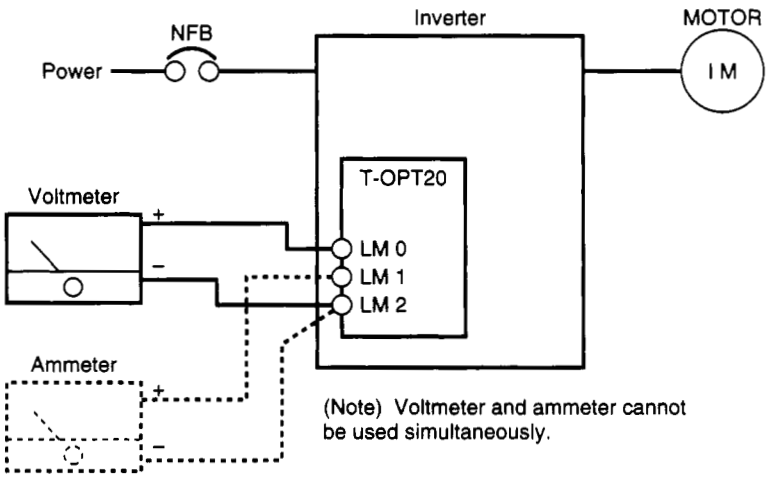
- Type of digital input signals ..... 4-digit BCD 16-bit binary
- Selection of digital input signals ..... Selected through parameter unit
- Input system ..... Contact signals or open collector input signals.
- Adjustment functions ..... (1) Bias and gain
  (2) Analog compensation input
  (Established through parameter unit)

# 5. ADD-ON ANALOG OUTPUT

One signal of 16 types of signals including output frequency, output current, etc., can be selected and read out as an analog signal on an ammeter or voltmeter that is connected to the corresponding terminals.

## 5-1 EXAMPLE OF WIRING

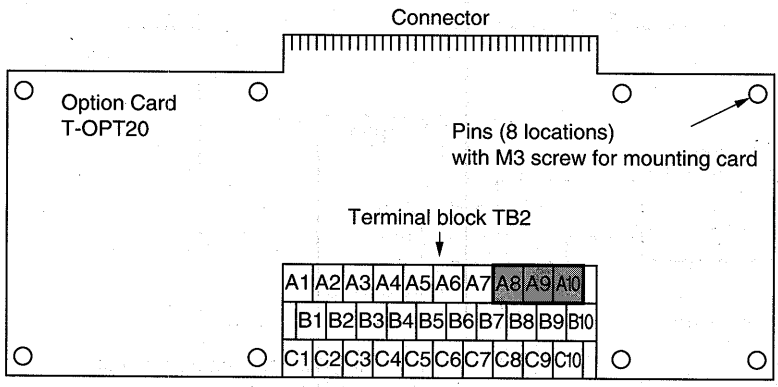
The voltmeter or ammeter is connected as shown in the following figure.




Note: Make sure that the wiring for the voltmeter or current meter does not exceed 10 m in length.

## 5-2 TERMINAL DESCRIPTIONS

| Terminal symbol | Signal symbol | Terminal name | Description |
|---|---|---|---|
| A9 | LM0 | Voltage output terminal | Direct current voltmeter (DC 10V) is connected. |
| A8 | LM1 | Current meter output terminal | Direct current ammeter (DC 1 mA) is connected. |
| A10 | LM2 | Common terminal | Common terminal for LM0 and LM1. |



## 5-3 ADJUSTMENT

(1) Parameters
Before operating the inverter, set the following parameters.

| Function No. | Function | Range of setting | Minimum increment | Ex-factory setting | Note |
|---|---|---|---|---|---|
| 135 | Analog output signal selection | 1 – 21 | 1 | 17 | Not valid for 4, 15, 16, 19 and 20 |
| 136 | Setting at zero analog output | 0 – 100% | 0.1% | 0% | |
| 137 | Setting at maximum analog output | 0 – 100% | 0.1% | 100% | |

(2) Analog output signal selection (Pr.135)
Use the table below to select the type of analog signal to be sent out through terminals A9 (LM0) and A8 (LM1).
Enter the signal number into parameter 135.

**List of signals**

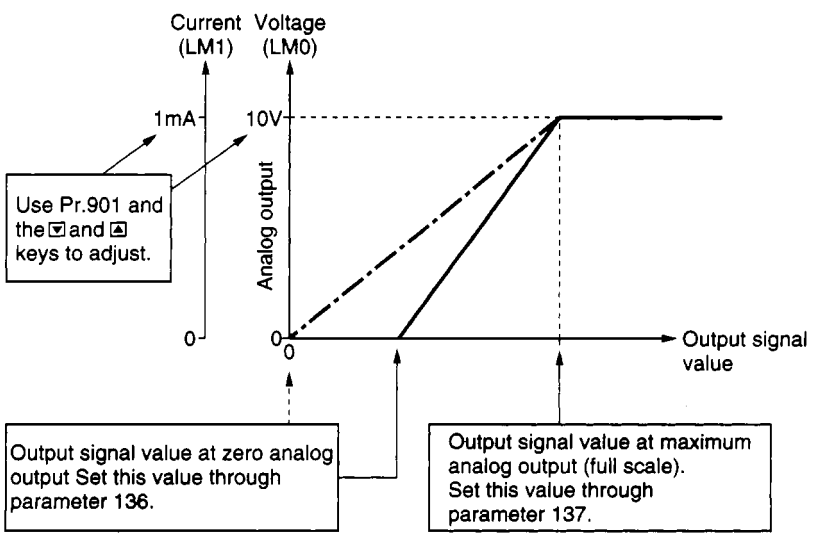
| Signal No. | Description of output signal | Full scale value |
|---|---|---|
| 1 | Output frequency (Hz) | |
| 2 | Output current (A) | |
| 3 | Output voltage (V) | 400 V or 800 V |
| 5 | Frequency setting (Hz) | |
| 6 | Operating speed | Value converted by Pr.37 |
| 7 | Motor torque (%) ※ | Twice the rated torque of motor used |
| 8 | Converter output voltage (V) | |
| 9 | Regenerative brake duty (%) | |
| 10 | Electronic thermal load ratio (%) | Thermal operation level |
| 11 | Peak output current (A) | |
| 12 | Peak converter output voltage (V) | 400 V or 800 V |
| 13 | Input power (kW) | Twice the rated power of motor used |
| 14 | Output power (kW) | Twice the rated power of motor used |
| 17 | Load meter (%) | |
| 18 | Motor excitation current (A) | |
| 21 | Reference voltage output | Full scale voltage and current are out on terminals LM0 and LM1 |

※ The motor torque is valid only when the primary magnetic flux control is selected on the inverter.

(3) Meter calibration (Pr.135, Pr.901 and [▼] and [▲] keys)

1) Connect a direct current voltmeter (or direct current ammeter) between terminal A9 ((LMO) or A8 (LM1)) and terminal A10 (LM2). Make sure that the polarity is correct.
2) Set Pr.135 (analog output signal selection) to "21" (reference voltage). Check that the meter pointer moves and the following analog signals are actually generated.
   - Between terminals A9 (LM0) and A10 (LM2) :
     Maximum output voltage previously set.
     (Factory setting is DC 10 V.)
   - Between terminal A9 (LM1) and A10 (LM2) :
     Maximum output current previously set.
     (Factory setting is DC 1 mA.)
3) Read Pr.901 (AM terminal calibration).
   In this condition, operate [▼] and [▲] keys on the parameter unit so that the meter pointer reaches the full scale value. Write the data and the calibration is complete.

(4) Adjusting analog signals (Pr.136 and Pr.137)
Set the zero analog output point (meter zero) and the maximum analog output (full scale) point as follows so that output signals (selected through Pr.135) are sent out as analog signals (output signals for meters) in the range of DC 0 to 10 V, or DC 0 to 1 mA.



## 5-4 CAUTIONARY NOTES

(1) The voltage output signals (terminal A9 (LM0)) and current output signals (terminal A8 (LM1)) cannot be used simultaneously.

(2) If a voltmeter having an internal impedance smaller than the values listed in the specification, or a current meter having an internal impedance larger than the values listed in the specification is used, the meter pointer will not reach the full scale value. Such meters cannot be calibrated.

(3) The full scale output is factory-set for DC 10 V and DC 1 mA meters. If a voltmeter (DC 7 V or smaller) having a full scale that is smaller than the factory setting, or a current meter (DC 0.7 mA or less) having a full scale that is smaller than the factory setting is used, the meter may be damaged during calibration.
To calibrate meters having smaller full scale values, first adjust the output at terminal A9 (LM0) or A8 (LM1)) to the minimum. Then connect the meter for calibration.

## 5-5 SPECIFICATIONS

(1) Output Signals
Voltage output (between terminals A9 (LM0) and A10 (LM2): DC 0 to 10 V
Current output (between terminals A8 (LM1) and A10 (LM2): DC 0 to 1 mA

(2) Output Resolution
Voltage outpu 10 mA
Current output 1 μA

(3) Indicator accuracy
±10% of the full scale output
May differ from one type of signal to another.

(4) Applicable meters
- Voltmeters
  Direct current voltmeter: full scale 10 V
  (internal impedance no smaller than 2.7 kΩ)
- Current meters
  Direct current current meter: full scale 10 mA
  (internal impedance no greater than 800 Ω)
- Wiring distance
  Maximum 10 m

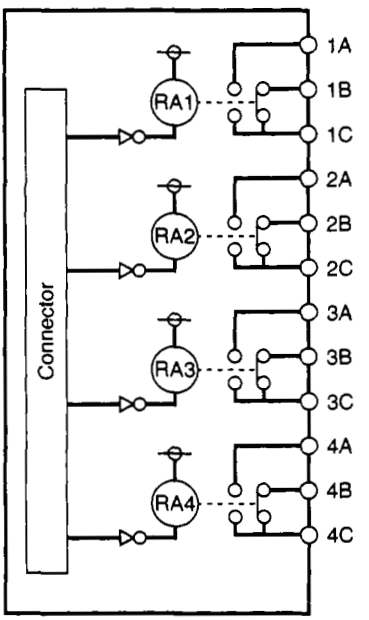
(5) Output Signal Descriptions

One signal of the following output signals can be selected and indicated (output): inverter output current (motor current), output frequency, output voltage, frequency setting, operation speed, motor torque, converter output voltage, regenerative brake duty, electronic thermal load ratio, peak output current, peak converter voltage, input power, output power, load meter, motor excitation current and reference voltage output.

# 6. RELAY OUTPUT

Four of the ten standard output signals (RUN, SU, IPF/UVT, OL1, FU1, FU2, RPB, THP, PRG, and PU) are selected and sent out through relay contacts (1C contacts).
Time-up signals and group selection signals during program operation and limit signals and direction signals are sent out during PI control.

## 6-1 INTERNAL BLOCK DIAGRAM

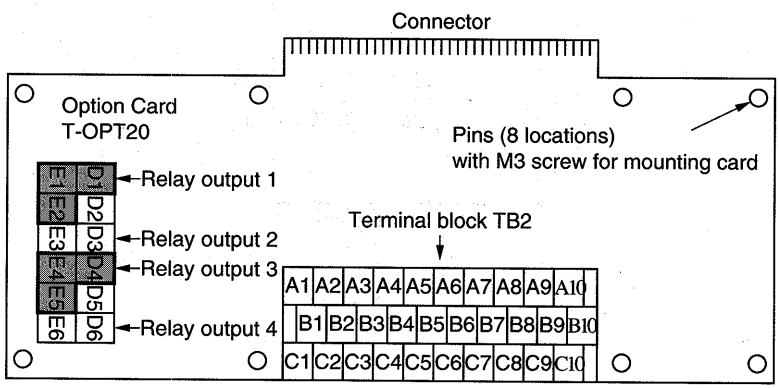



Internal circuit diagram

## 6-2 TERMINAL DESCRIPTIONS

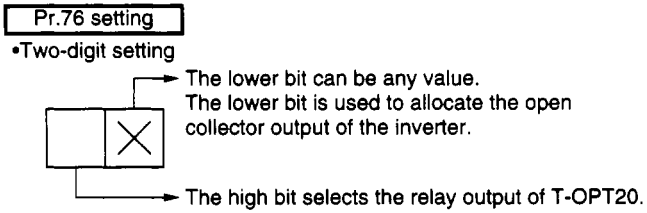
| Terminal symbol | Signal symbol | Description |
|---|---|---|
| E1 | 1A | Normally open contact terminal for relay RA1 |
| E2 | 1B | Normally closed contact terminal for relay RA1 |
| D1 | 1C | Common terminal for relay RA1 contacts |
| D2 | 2A | Normally open contact terminal for relay RA2 |
| D3 | 2B | Normally closed contact terminal for relay RA2 |
| E3 | 2C | Common terminal for relay RA2 contacts |
| E4 | 3A | Normally open contact terminal for relay RA3 |
| E5 | 3B | Normally closed contact terminal for relay RA3 |
| D4 | 3C | Common terminal for relay RA3 contacts |
| D5 | 4A | Normally open contact terminal for relay RA4 |
| D6 | 4B | Normally closed contact terminal for relay RA4 |
| E6 | 4C | Common terminal for relay RA4 contacts |

- Each relay actuates depending on the selected output signals.
  Contact capacity: AC 230 V, 0.3 A
  DC 30 V, 0.3 A



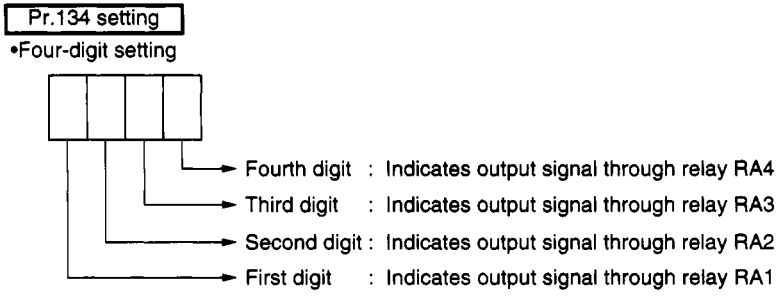
## 6-3 OUTLINE

(1) Output signal selection 1
Depending on the parameter 76 setting, the following data is indicated.




- 0 ..... Ten signals including RUN, SU, IPF, etc. can be allocated.
- 1 ..... Alarm code is allocated.
- 2 ..... RUN, SU, IPF, etc. are output in normal condition. Alarm code is output in abnormal condition.
- 3 ..... Time-up signal and group selection signal are allocated.
- 5 ..... Limit signal and direction signal are allocated during PI control.

(2) Output signal selection 2
Depending on the parameter 134 setting, output signals through relays RA1 through RA4 are any of the ten signals such as RUN, SU, IPF, etc.



Description of signals

Depending on number in each digit of parameter 134, the following signals can be selected.

| Setting | Signal description |
|---|---|
| 0 | Inverter is in operation (RUN). |
| 1 | Frequency arrive (SU). |
| 2 | Instantaneous power failure or under-voltage (IPF/UVT). |
| 3 | Overload alarm (OL) |
| 4 | Frequency detection for over frequency arrive (FU1) |
| 5 | Secondary frequency detection for over frequency arrive (FU2) |
| 6 | Regenerative brake pre-alarm (RBP) |
| 7 | Electronic thermal pre-alarm (THP) |
| 8 | In program mode operation (PRG) |
| 9 | PU operation mode (PU) |

Example: Pr.134 = 0123 (factory setting)
RA1: Inverter is in operation (RUN).
RA2: Frequency is reached (SU).
RA3: Instantaneous power failure or under-voltage (IPF/UVT)

(3) Alarm code output
This is the same function as for the open collector output on the circuit board on the inverter.
See the operation manual of the inverter.

(4) Program operation signal output
Relay RA1 ..... Time-up signal
Relay RA2 ..... Group 3 selection signal
Relay RA3 ..... Group 2 selection signal
Relay RA4 ..... Group 1 selection signal

(5) Signal output during PI control
(will be on market shortly.)
Relay RA1 ..... Upper limit
Relay RA2 ..... Lower limit
Relay RA3 ..... Normal operation output
Relay RA4 ..... Reverse operation output

(6) Regenerative brake pre-alarm (RBP)

The pre-alarm signal is generated when 85% of the regenerative brake duty established through parameter Pr.70 is reached.

# 7. 12-BIT A/D CONVERTER FOR FREQUENCY SIGNALS

The T-OPT20 is equipped with a 12-bit A/D converter. With this converter connected to the main control circuit board on the inverter, the 12-bit resolution is automatically applied to frequency commands such as 0 to 5/10 V, 0 to ±5 V/±10 V, 4 to 20 mA, etc.