TAZUNA Unit: TAZ－111

PQ roid (Drill Identification System)

User’s manual

Important

Read this manual thoroughly prior to installation of TAZUNA unit: TAZ-111.
Follow each instruction given in this manual carefully to ensure the correct and efficient installation and use of the product.
This manual gives basic suggestions and instructions on installation, operation, trouble-shooting. Operation before reading this manual may cause personal injury and/or equipment damage.

Store this manual in a safe place for reference

Create the New Stream!
Nippon Oil Pump Co., Ltd.

TAZ201810

INDEX

Description of the Product

This product is a programmable and multifunctional digital processing board, equipped with input / output and a single chip microcomputer necessary for receiving and controlling the signals from connected devices. This product is designed to control the system to serve the purpose of your applications.

This product complies with the EMC Directive (IEC/EN61000-4-3, IEC/EN61000-4-4IEC /EN61000-4-6, IEC/EN361000-6-4）
Read the safety precautions for the proper use conditions.
This manual contains introduction, usage and safety precautions of the product.
Be sure to read this manual before using this product.
We accept no responsibility for any personal injury or equipment damage caused by not following the instructions stated in this manual.

For Safety Operation

Be sure to understand the safety countermeasures and follow the precautions and operating instructions stated in this manual for safe operation.
When you see the following symbols and titles in this manual, be especially alert to the potential for personal injury or property damage.

This manual uses the following symbols and titles to identify the risk and danger levels.

⚠ **Danger:**	Failure to follow instructions will result in death or serious personal injury.
⚠ **Warning:**	Failure to follow instructions can result in death or personal injury.
⚠ **Caution:**	Failure to follow instructions can result in personal injury or pump and other equipment damage.

⚠ **Danger**
Make sure that power is always disconnected to the product before performing any respective tasks such as installation, wiring, inspections or maintenance work.
Do not touch the circuit board or terminals while power is connected to the product. Misuse or abuse of this product may cause electric shock.
Transporting, installation, wiring, operation, or maintenance work must be performed by personnel specifically knowledgeable in the respective task, and any legally regulated work must be performed by personnel properly qualified under the related law.

⚠ **Warning**
Never modify or alter the product. It may cause electric shock. Any alteration of the product made by customers or users will void the warranty.
Make sure that the voltage of incoming power supply matches the rated voltage of the product before connecting power source to the product. Applying wrong voltage may cause fire or damage to the product.
Running the product in a temperature over the specified range may result in serious accident by damaging the product or connected components.
If the product is attached inside a closed-type cabinet, make sure that the ambient temperature is 40˚C or less by cooling it with fan, air-conditioner. Improper handling of the product may cause overheating or fire.

⚠ **Caution**
If any abnormality is observed, stop the operation immediately.
Make sure that the product is kept clean from cutting swarf, oil or any other liquid by covering up with cloth, paper during the installation. It may result in product damage or malfunction if failed. Be sure to remove the cover after the installation is completed.
Follow the procedures shown in Electro-Static Discharge (ESD) protection when handling the product. Improper handling may damage the circuit by static electricity.
Be sure to sufficiently protect noise sensitive devices from electrical noise interference if any placed near this product.
If the product must comply with EMC directive, take the following measures. · Analog/digital input/output cable must be less than 3m length. · Install a cable with ferrite core · Connect GND for electromagnetic shielding

1. Hardware Specification

1. 1 Design and Dimensions

Overview of TAZ-111 CPU

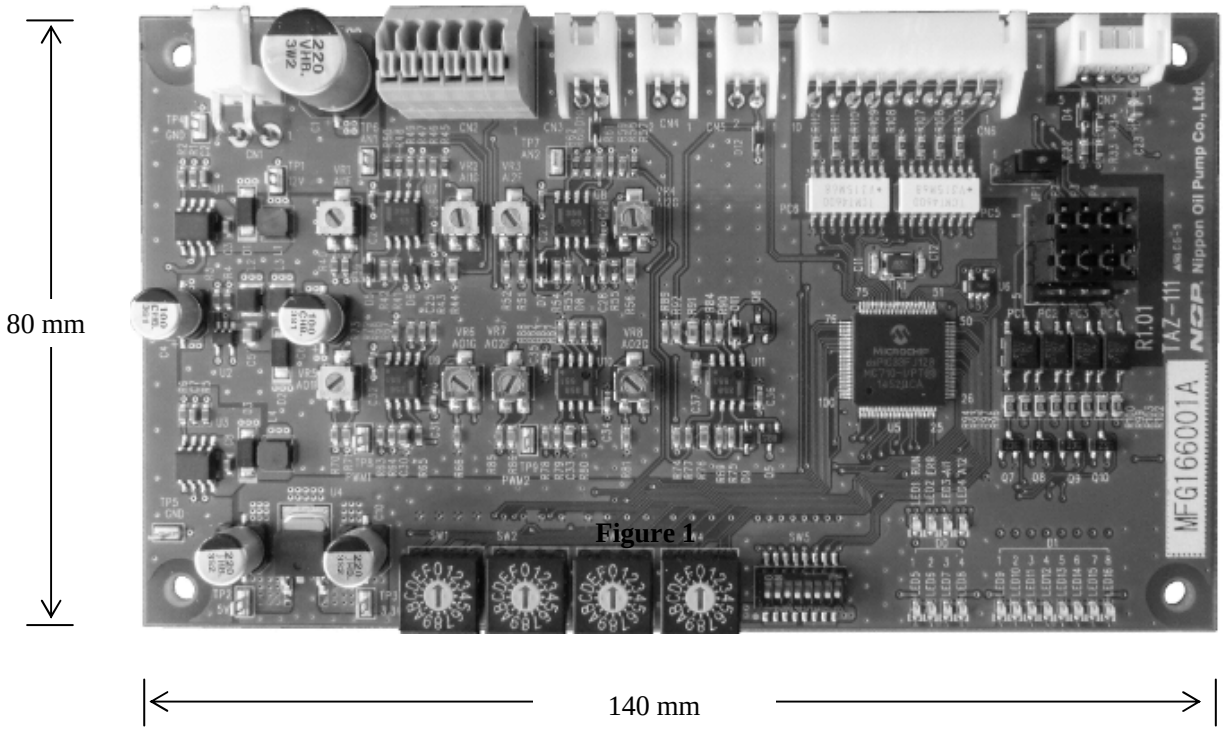


Figure 1

Figure 1

1. 2 Name of Each Component

○ **Components of TAZ-111**

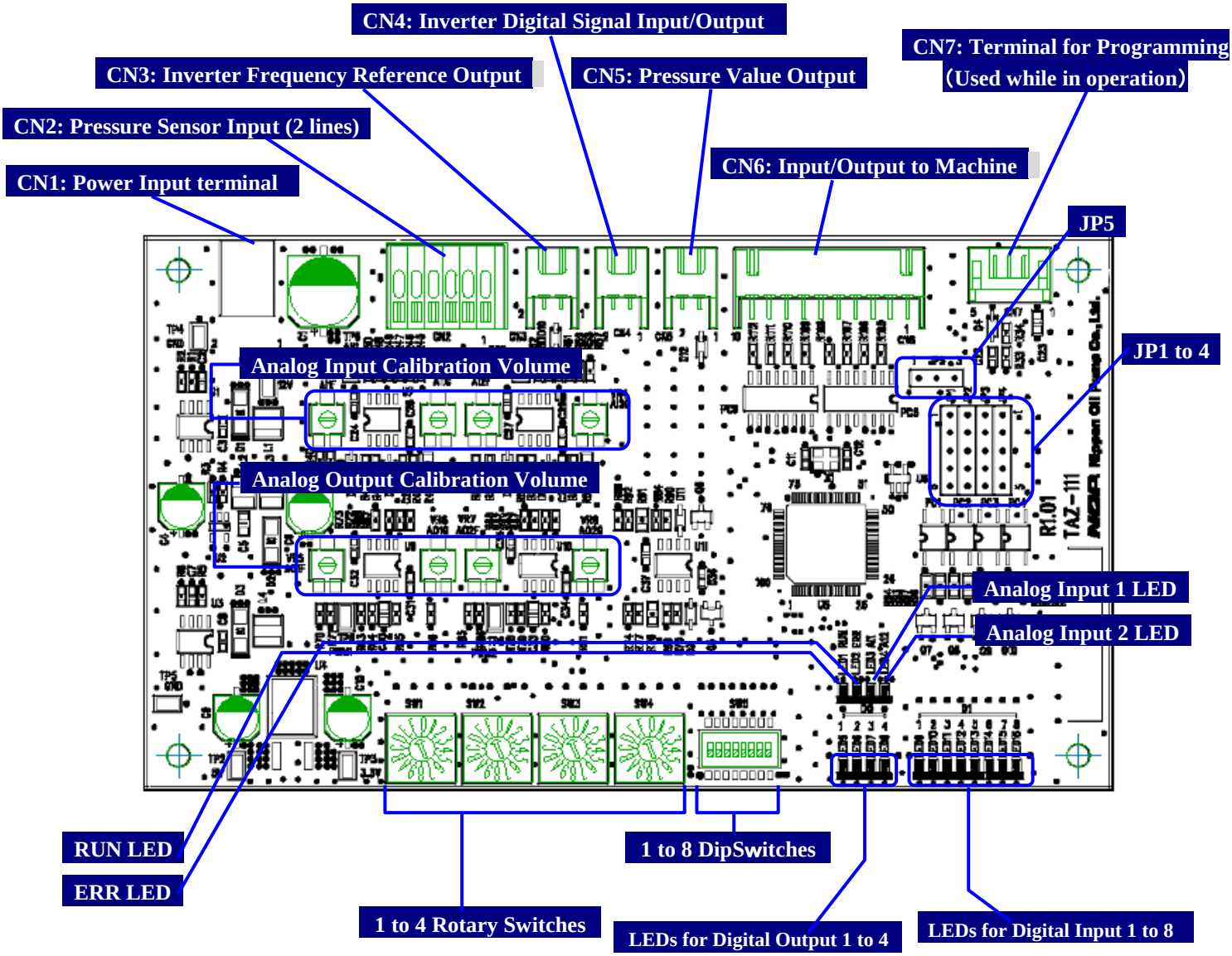


Figure 2

1. 3 Specification Table

Table 1

Item			Specifications
General specifications		Ambient temperature	-10 to 40°C (when operating), -20 to 60°C (in storage)
		Ambient humidity	10 to 85% (when operating), 10 to 90% (in storage) no condensation
		Installed location	Indoors (free of corrosive gas or dust)
		Input power	DC24V±10%
		Power consumption	10W
		External dimensions	W140×D80×H20 (mm)
Input	Digital	Number of input ports	8 ports
		Input signal type	DC voltage-free contact input Sink input mode: NPN open-collector transistor Source input mode: PNP open-collector transistor (Sink/source input are selected by jumper switch setting)
		Input operation indicator	An LED (red) is lit when input is on.
	Analog	Number of input ports	2 ports
		Input range	DC4 to 20 mA
		Resolution	Approx.16 μA (in 1024 steps)
		Input operation indicator	An LED (red) is lit when analog input is on.
	SW	Number of input ports	2-position switching: 8 ports (Rotary DipSWitch, 8-poles, on-off)
			16-position switching: 4 ports (DipSWitch, 16-position)
Output	Analog	Number of transistor output ports	4 ports (with independent common)
		Maximum load	Maximum load voltage DC 300 V, resistive load, maximum 0.15 A (per output port)
		Output operation indicator	An LED (red) is lit when output is on.
		Maximum response time	85 μs
	SW	Number of output ports	2 ports
		Output range	DC4 to 20 mA
		Resolution	Approx.16 μA (in 1024 steps)
CPU		Processor	dsPIC33FJ128MC710
		Number of bits	16-bit
		Memory	RAM: 16 KB ROM: 128 KB
		Speed	40 MIPS*
		Cache	2 KB DMA memory
Non-volatile memory		EEPROM	8 KB
Operation indicator specifications			On normal operation: RUN LED (green) is lit. On error: FAIL LED (red) is lit.

* MIPS is an abbreviation for "Million Instructions Per Second", which is one of the indicators of a computer's processor speed.

2. Connection & Settings

The following chapter gives you instructions about installation, wiring and product setting that you must follow for the product set up.

2. 1 Connection

There is more than one way to connect signal input depending on whether sensor is connected or not, what type of sensors are connected. Read the corresponding sections for the details of how to connect TAZ-111 to power supply as well as other peripheral components.

2. 1. 1 Power Supply

Connect the power supply to terminal CN1.
Use VH connector (the Product of J.S.T Mfg. Co., Ltd.)
*See "[2.1.7] Applicable cable/terminal list" for applicable cable diameters and terminals for the connections.

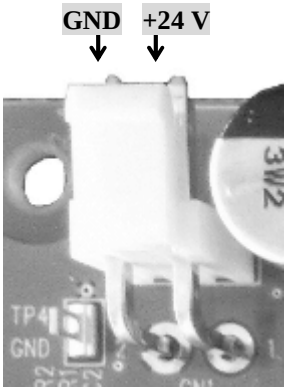


Figure 3

【Wiring diagram】

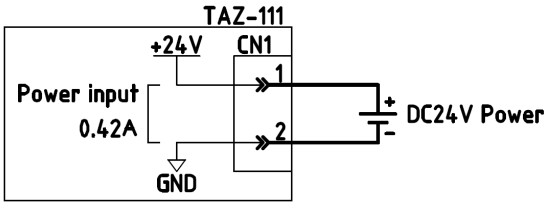


Figure 4

⚠ **Cautions** Do not reverse the polarity of connections as it may destroy the entire electric circuit.

2. 1. 2 Pressure Sensor Input

CN2 is the pressure sensor input terminal.

See available pressure sensor inputs from " Table 2".

Table 2

Function of pressure sensor	Pressure range	Output current range	Connection port
Pressure control (2 MPa)	0 to 2.5 MPa	4 to 20 mA	Pressure sensor input1
Pressure control (7 MPa)	0 to 10 MPa		
Clogging detection for inline filter (2 MPa)	0 to 2.5 MPa		Pressure sensor input 2
Clogging detection for inline filter (7 MPa)	0 to 10 MPa		
Clogging detection for suction area	-0.1 to 0.1 MPa		

*If you use the clogging detection sensor for inline filter, pressure control sensor must be installed in advance. Model number of the terminal block is 250-406 6-P 2.5MM GRAY, the product of WAGO

*See "[2.1.7] Applicable cable/terminal list" for applicable cable diameters and terminals for the connections.)

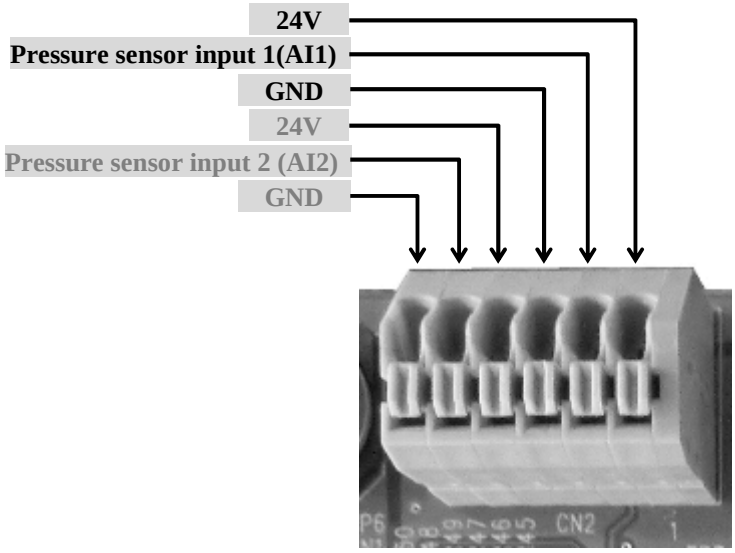


Figure 3

【Wiring diagram】

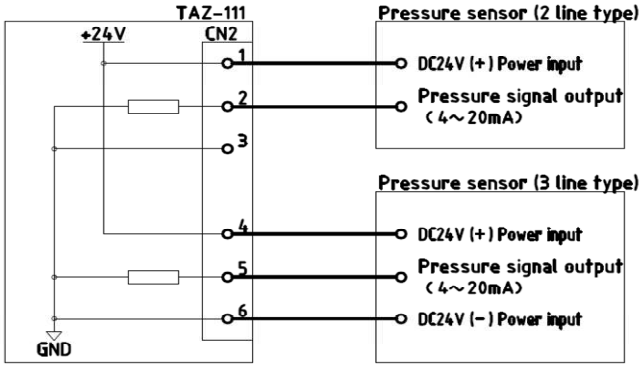


Figure 4

*Either CN2-1, 2, 3 or CN2-4, 5, 6, can be connected to 2 line type or 3 line type.

2. 1. 3 Inverter Frequency Reference

CN3 is the inverter frequency reference output terminal. Only the type of inverter capable of running the drive by inputting 4 to 20mA (0 to 66.7 Hz) can be used.
Please use XH connector, made by Japan Crimp Terminal Mfg. Co., Ltd.
*See [2.1.7] (Applicable cable/terminal list) for applicable cable diameters and terminals for the connections.)

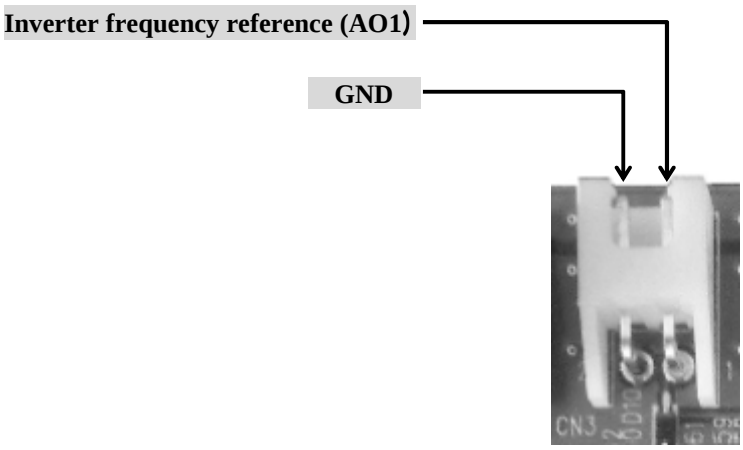


Figure 5

【Wiring diagram】

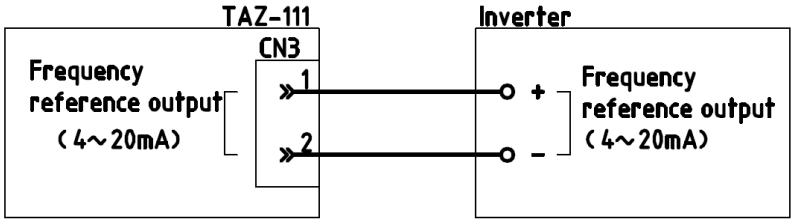


Figure 6

2. 1. 4 Digital Signal Input / Output

CN4 is the inverter digital signal input/output terminal.
Connect the inverter normal signal input to terminal CN4-1.
Connect the inverter's run command output to terminal CN4-2.
*Whether terminal CN4-2 is necessary to be connected or not depends on manufacturer or model of the product.

Switching between sink and source input / output is carried out through jumper switches from JP1 to JP5.
*See "2.2 Jumper switch setting" for setting patterns of jumper switches.

Please use XH connector, the Product of Japan Crimp Terminal Mfg. Co., Ltd.
*See "2.1.7 applicable cable/terminal list" for applicable cable diameters and terminals for the connections.

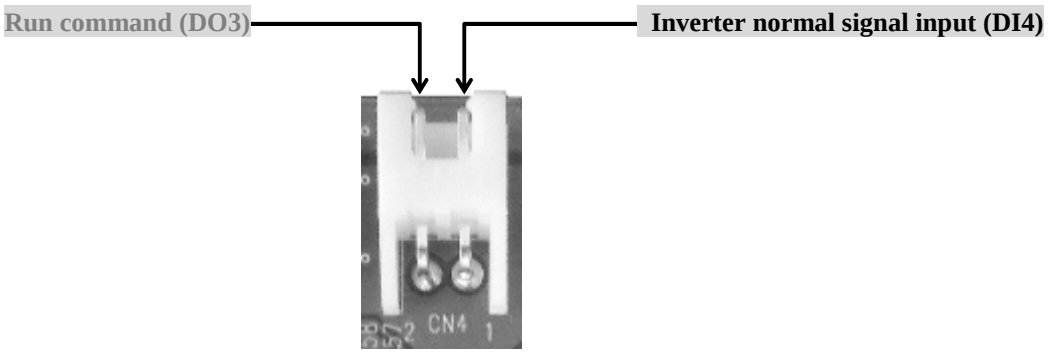


Figure 7

【Wiring diagram for source input】

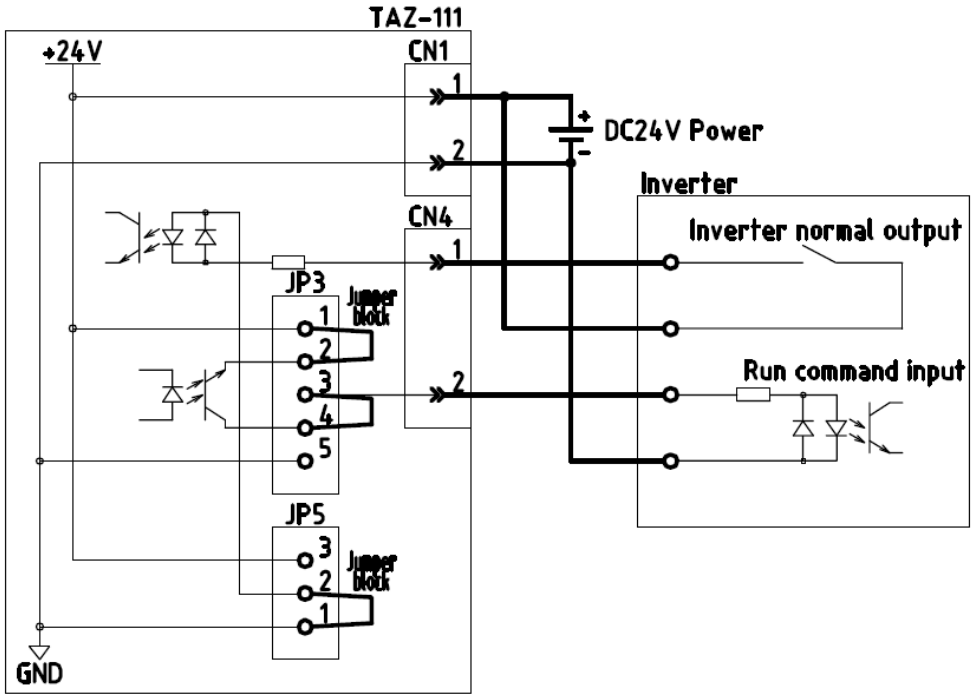


Figure 8

【Wiring diagram for sink input】

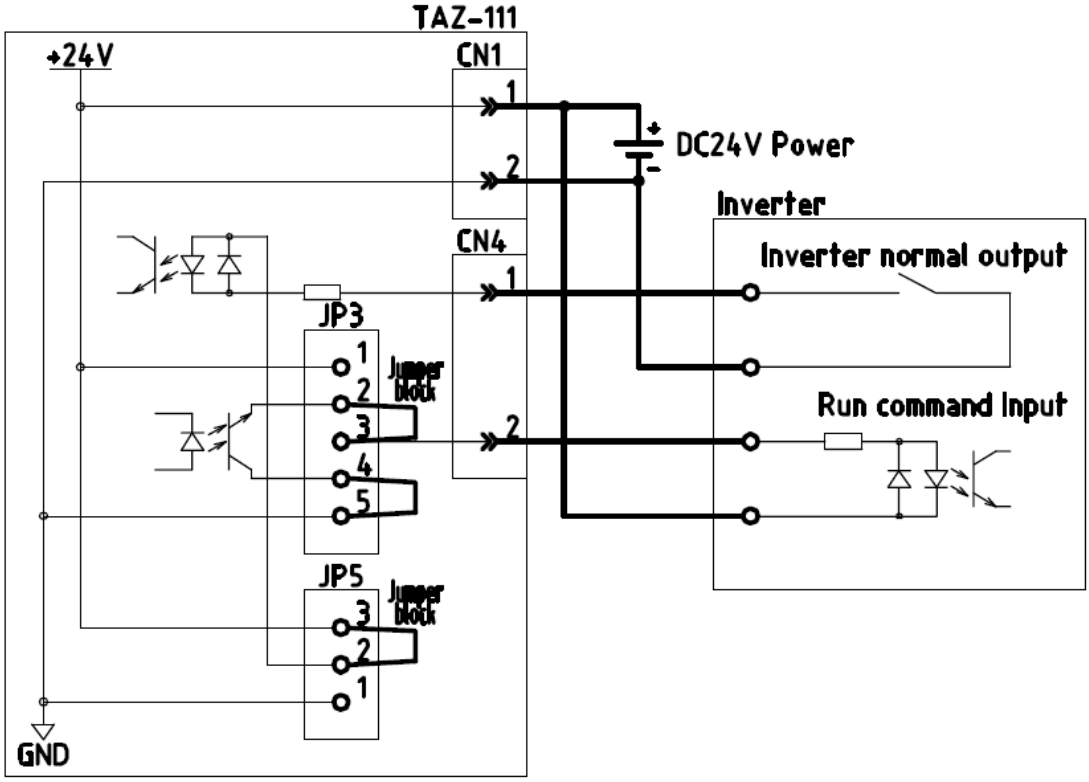


Figure 9

2. 1. 5 Pressure Value Output

When a connected host machine, such as a machining center or other machine tools, requires pressure value, output from terminal CN5 is available in the range from 4 to 20 mA
This step is unnecessary if there is no such a requirement from your host machine.

Please use XH connector, the Product of J.S.T. Mfg. Co., Ltd.
*See “2.1.7” applicable cable/terminal list for applicable cable diameters and terminals for the connections.

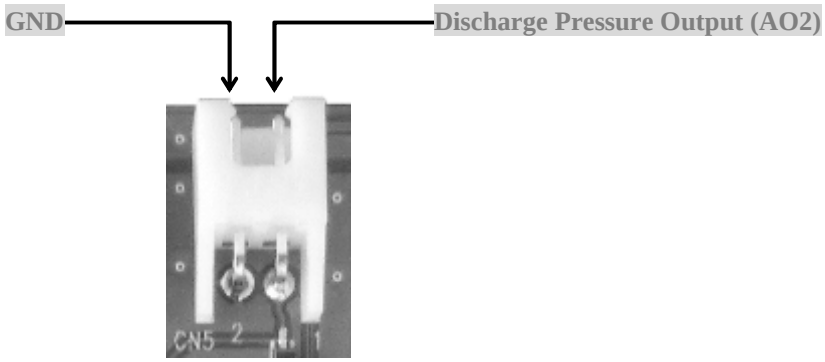


Figure 10

【Wiring diagram】

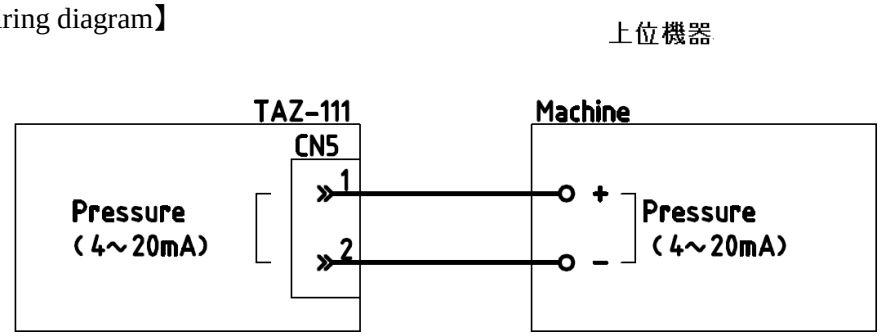


Figure 11

2. 1. 6 Host Device Input / Output

Sending out commands to and receiving responses from a host machine, such as machining center or other machine tools, by digital input/output will be carried out through terminal CN6. As shown in “Figure 12”, these functions are assigned to the terminals CN6-1 to CN6-10.

* CN6-1 to CN6-5 must be connected for driving TAZUNA.

Please use XH connector, the product of J.S.T. Mfg. Co., Ltd.

*See “2.1.7” applicable cable/terminal list for applicable wire diameter and terminals for the connections.

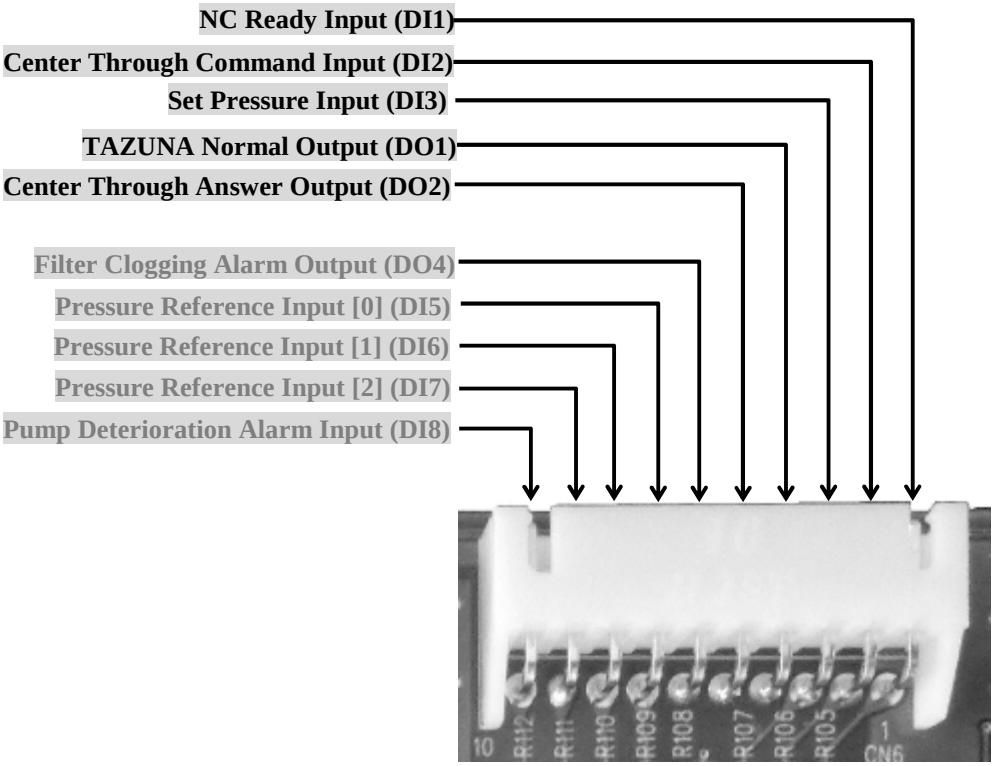


Figure 12

【Wiring diagram for source input】

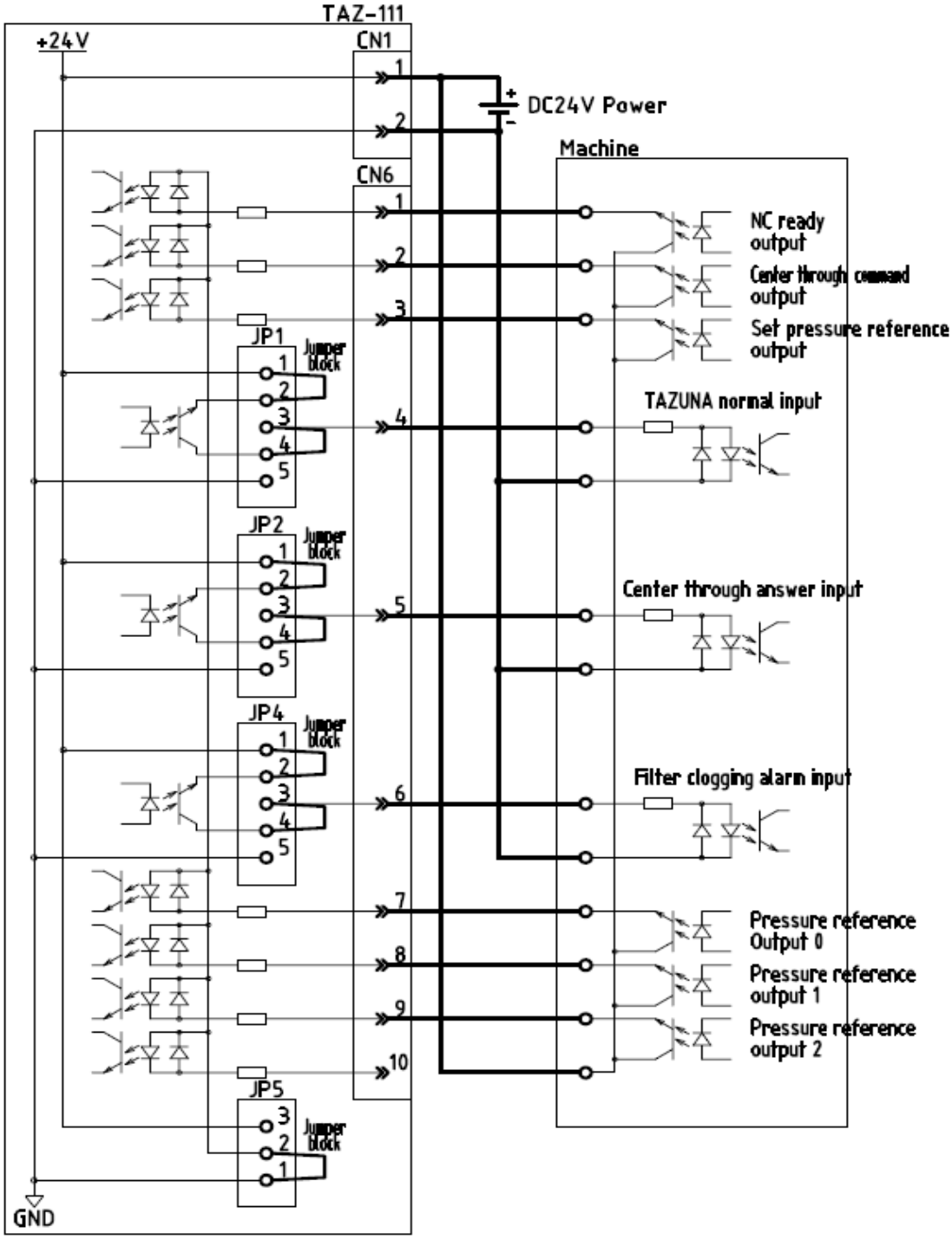


Figure 13

【Wiring diagram for sink input】

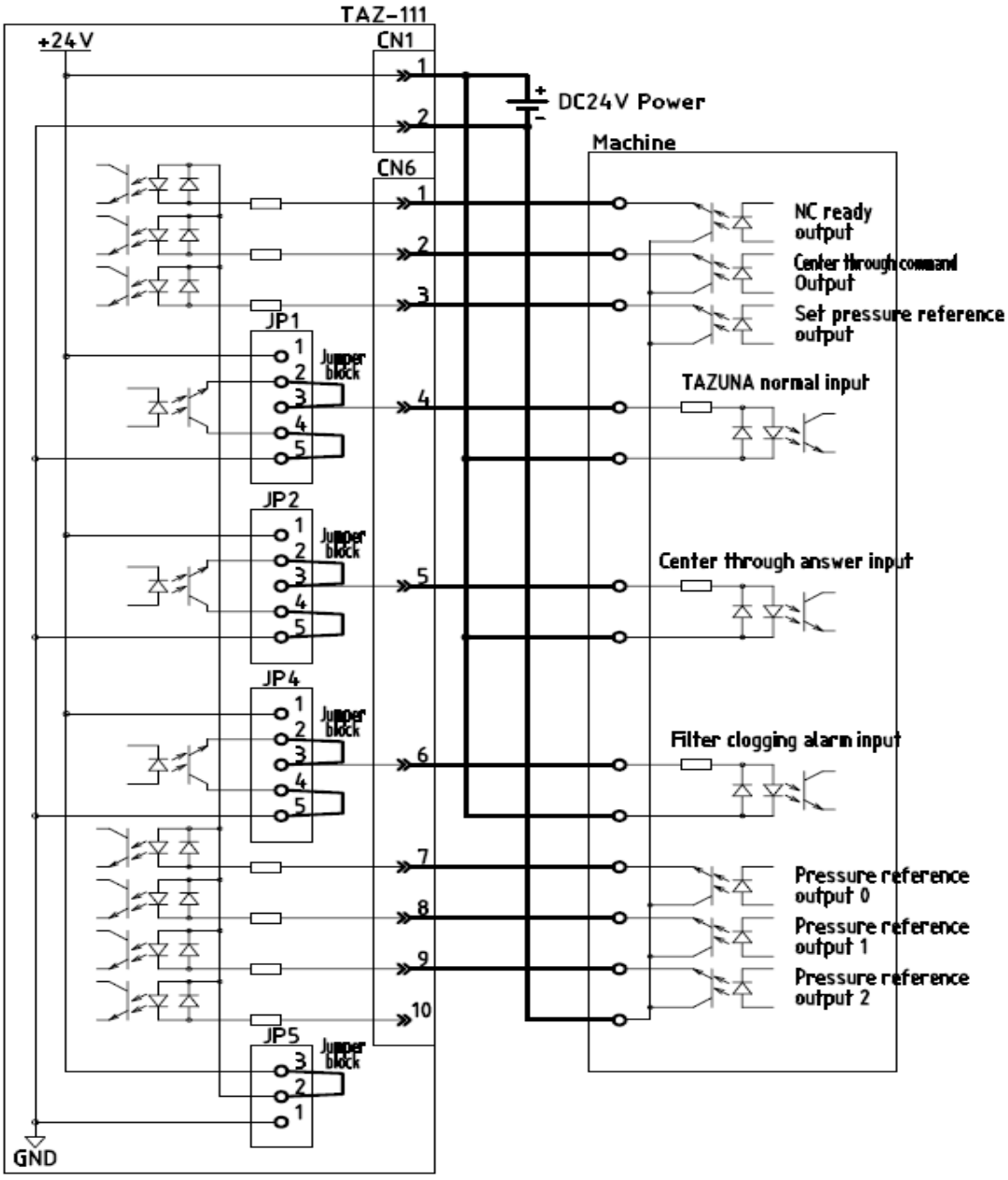


Figure 14

2. 1. 7 Applicable Cable/Terminal List

・CN1

CN1 is the 2-pin VH connector, the product of J.S.T. Mfg. Co., Ltd.
Following are the applicable connector types for the connections.

・Connector housing: VHR-2N
・Contact: BVH-41T-P1.1
・Applicable cable range (AWG): #20 to 16
・Outer diameter of coated cable (mm): 1.7 to 3.0
・Crimping tool: YC-930R
*The product of J.S.T. Mfg. Co., Ltd. or other crimping tools for VH connector.

・CN2

Following are the cables applicable to WAGO terminal block.

・ Applicable cable diameter (single cable): φ 0.4 to 0.8 mm
・ Applicable cable diameter (Flexible strand): 0.2 to 0.5 mm^2
・ Maximum coated outer diameter: φ1.8mm or less

・CN3 to 6

Terminals CN3 to 5 is 2-pin XH connector and terminal CN6 is 10-pin XH connecter.
*The product of J.S.T. Mfg. Co., Ltd.
Following are the applicable connector types for the connections.

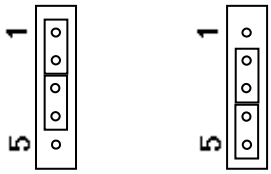
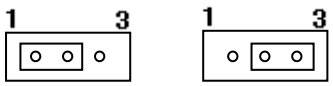
・ Connector housing:
・ CN3 to 5: XHP-2
・ CN6: XHP-10
・ Contact: BXH-001T-P0.6
・ Applicable cable range (AWG): #28 to #22
・ Cable coated outer diameter (mm): 0.9 to 1.9
・ Crimping tool: YC-110R
*The product of Mfg. Co., Ltd. or other crimping tools for XH connector.

Table 3

AWG	Cable diameter		AWG	Cable diameter	
	(inch)	(mm)		(inch)	(mm)
16	0.0508	1.291	**22**	0.0253	0.644
17	0.0453	1.150	**23**	0.0226	0.573
18	0.0403	1.024	**24**	0.0201	0.511
19	0.0359	0.912	**25**	0.0179	0.455
20	0.0320	0.812	**26**	0.0159	0.405
21	0.0285	0.723	**27**	0.0142	0.361
			28	0.0126	0.321

2. 2 Jumper Switch Setting

Table 4

Jumper	Function	Description
JP1	DO1 output COM format Source(PNP) ＝ 1･2 / 3･4 Sink(NPN) ＝ 2･3 / 4･5	Source Sink  【Factory default settings】
JP2	DO2 output COM format Source(PNP) ＝ 1･2 / 3･4 Sink(NPN) ＝ 2･3 / 4･5	
JP3	DO3 output COM format Source(PNP) ＝ 1･2 / 3･4 Sink(NPN) ＝ 2･3 / 4･5	
JP4	DO4 output COM format Source(PNP) ＝ 1･2 / 3･4 Sink(NPN) ＝ 2･3 / 4･5	
JP5	Input COM format Source(PNP) ＝ 1･2 Sink(NPN) ＝ 2･3	Source Sink  【Factory default settings】

In default jumper setting, JP1 to 4 are assigned to the 4 continuous jumper blocks.
If individual setting for DO1 to 4 is required, replace them with independent type jumper blocks. “Figure 15” is a sample configuration for source setting.

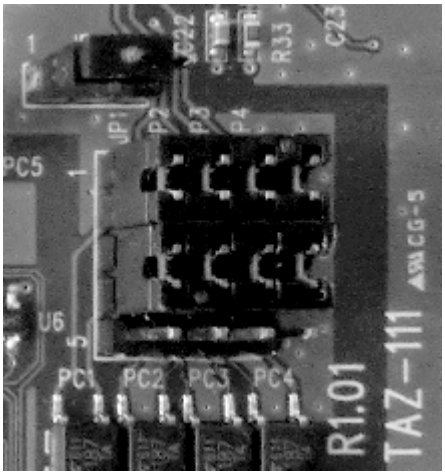


Figure 15

2. 3 Analog Input / Output Adjustment (Calibration)

Basically no adjustment is required as the product is already pre-adjusted before leaving the factory.
*Be careful not to change the setting carelessly as it may cause malfunction.

Offset/gain for each analog input/output are adjustable.
*See "Figure 16", VR1 to VR8 are the gain / offset controllers adjustable with a screw driver.

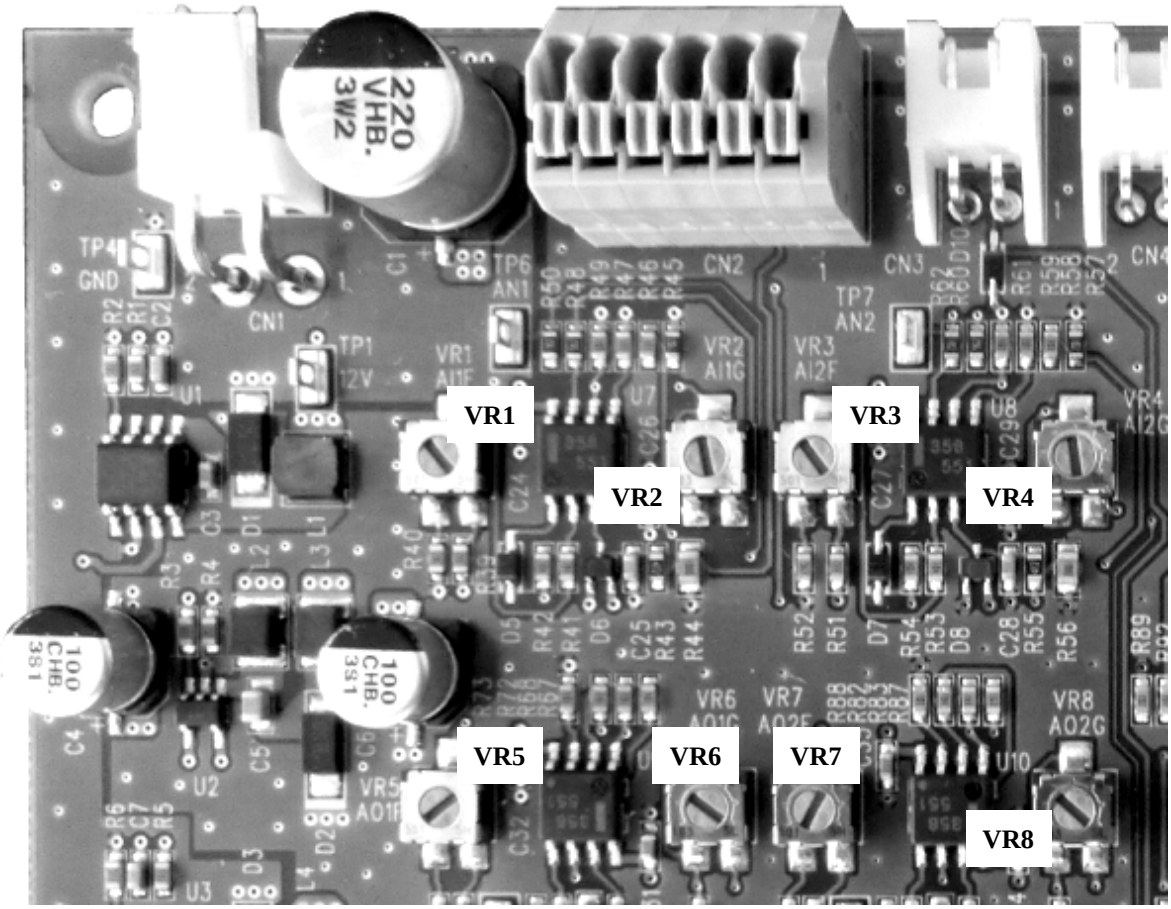


Figure 16

As shown in "Figure 17", to increase, turn VR 1-8 clockwise by using a screw driver and turn VR* counter-clockwise to decrease by referring to below "Table 5".

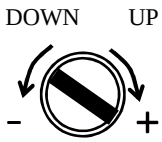


Figure 17

Table 5

VR No.	Name	Description
VR1	Analog input 1 Current offset	Offset adjustment from 4 to 20 mA input
VR2	Analog input 1 Current gain	Gain adjustment from 4 to 20 mA input
VR3	Analog input 2 Current offset	Offset adjustment from 4 to 20 mA input
VR4	Analog input 2 Current gain	Gain adjustment from 4 to 20 mA input
VR5	Analog output 1 Current offset	Offset adjustment from 4 to 20 mA output
VR6	Analog output 1 Current gain	Gain adjustment from 4 to 20 mA output
VR7	Analog output 2 Current offset	Offset adjustment from 4 to 20 mA output
VR8	Analog output 2 Current gain	Gain adjustment from 4 to 20 mA output

3 Drill Identification System（PQroid）

The following chapter describes how to use Drill Identification System, PQroid, which is pre-installed in this product.

3. 1 System Overview

This is the optimized fluid control system (software) specially developed for NOP coolant unit. With our special control system which enables TAZUNA to automatically recognize the drill hole diameter based on the pressure it receives from pressure sensor, coolant is supplied to your machining center at an optimum pressure and flow rate specifically adjusted for your drill diameter. The system also controls the pressure to maintain at constant rate.

3. 1. 1 Example of System Configuration

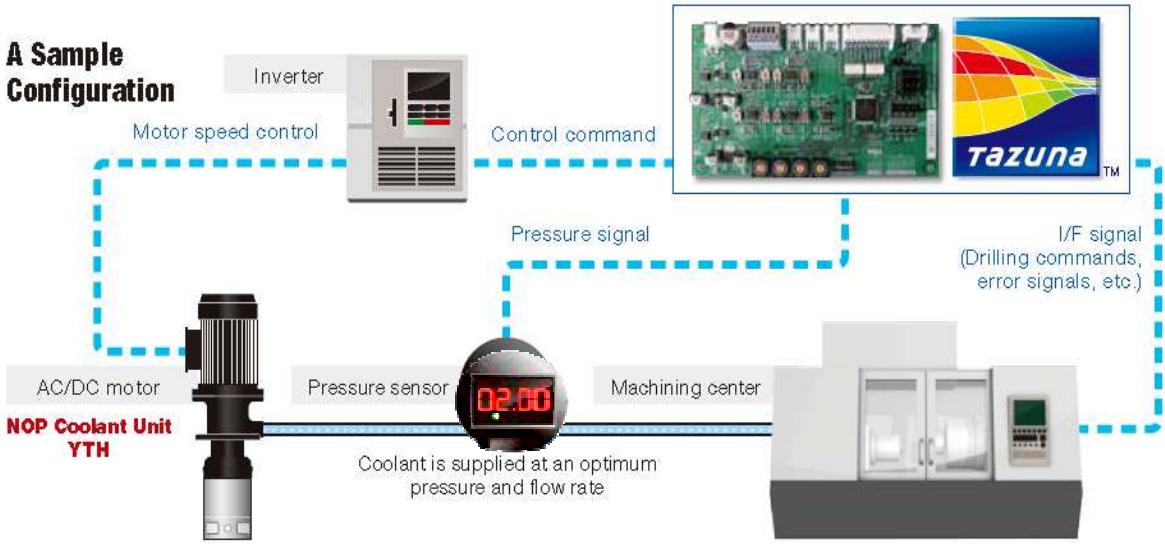


Figure 18

3. 1. 2 Block Diagram

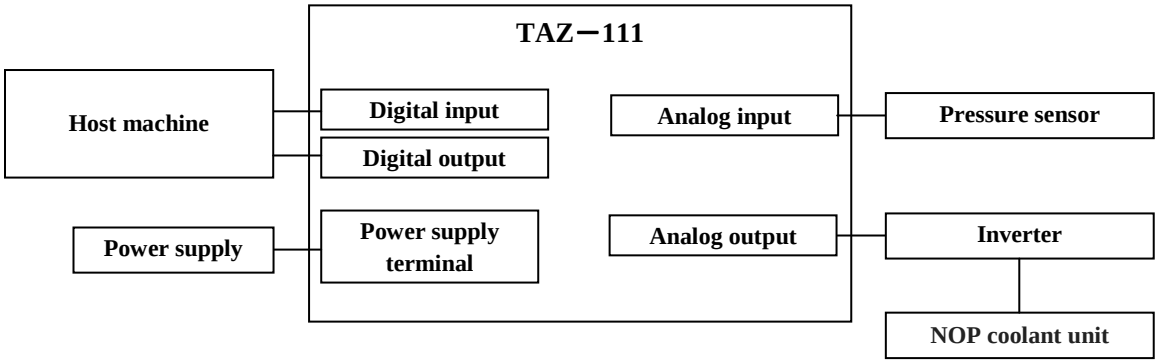


Figure 19

3. 1. 3 POroid system flow

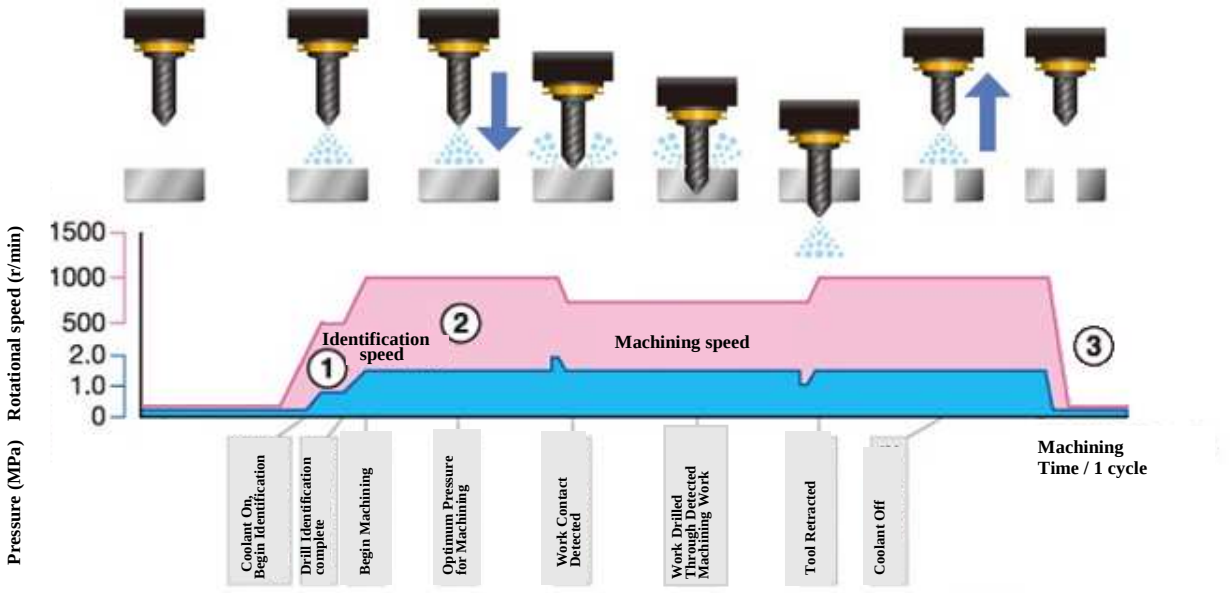


Figure 20

① Following a COOLANT-ON input, coolant will be injected at the drill identification speed at 1000 r/min and identify the drill hole diameter. Identification is implemented by matching the coolant discharge pressure and the identification table.

② The system controls the rotational speed so as to give an optimum machining pressure and flow rate for the drill-hole diameter as identified. The system continuously controls the rotational speed to give an optimum machining pressure and flow rate during the machining of work.

③ On completion of the drilling, the motor stops running and the pump discharge stops accordingly.

3．1．4 Sample of Drill Identification Database*1

Table 6

Drill hole diameter table (2 hole type)※2	Machining pressure table
Under φ1.209 mm	7.0 MPa
φ1.21 to 1.289 mm	6.5 MPa
φ1.29 to 1.379 mm	6.0 MPa
φ1.38 to 1.449 mm	5.5 MPa
φ1.45 to 1.549 mm	5.0 MPa
φ1.55 to 1.639 mm	4.5 MPa
φ1.64 to 1.809 mm	4.0 MPa
φ1.81 to 1.939 mm	3.5 MPa
φ1.94 to 1.989 mm	3.0 MPa
φ1.99 to 2.199 mm	2.5 MPa
Over φ2.20 mm	2.0 MPa

* 1: The table above is a sample case for SW2 = 7 (no offset).
The pressure of the machining pressure table is adjustable with SW2 setting.
* 2: The values above are each hole diameter of 2-hole type drill for center through application.

3．2 Constant Pressure Control

This system could control fluid pressure at constant rate.
To maintain a constant pressure, the internal pipe pressure is recognized as a signal through analog input and command is sent out to control the motor rotational speed.

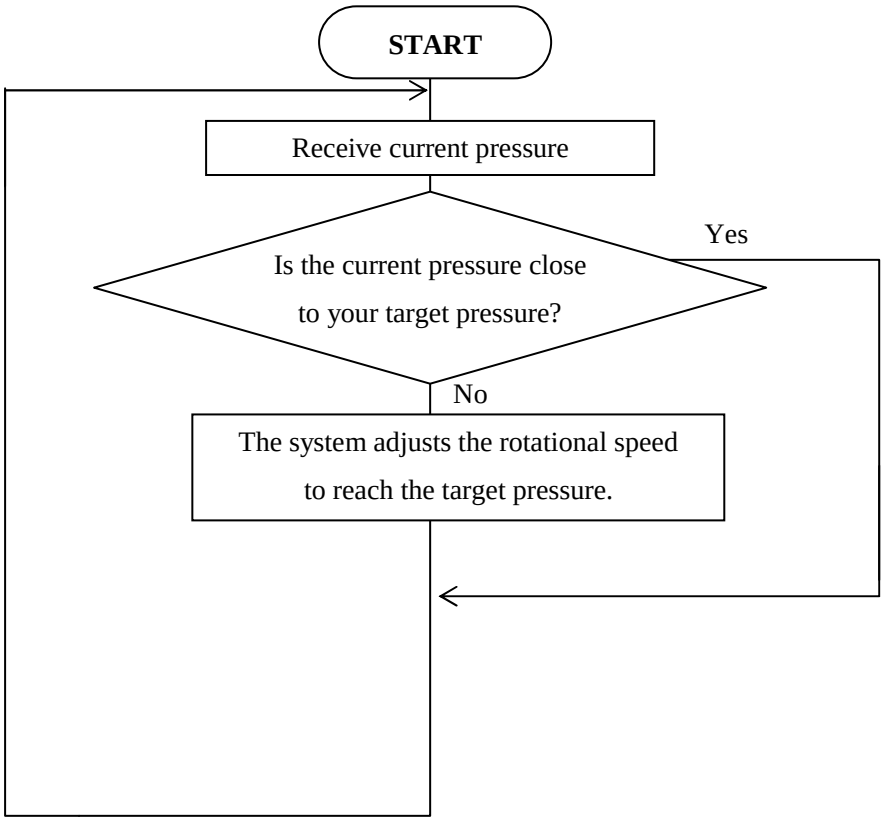


Figure 21

3. 3 Pump Deterioration Alarm Function

This function is provided to evaluate the status of your pump deterioration.
Your current pump deterioration status can be evaluated by compared with initial (new pump) performance. The result will be indicated as follows as the pump performance deteriorates.

1) Normal → 2) Alarming signal output → 3) Abnormal stop.

3. 3. 1 Overview

① Selection of the drill for your current pump status evaluation.

Select a drill for creating a baseline and evaluating your pump deterioration status. Suitable drill diameters for Center through operation varies in a range depending on pump models.
See “ Table 7” on the next page.

* It is strongly advised to prepare and keep a spare drill as a baseline for status evaluation is created only by the drill you originally select. Since drill hole diameters and number of holes are different from drill to drill, changing drills makes it impossible to carry out the status evaluation under the same conditions.

② Measurement of initial performance *See “3.3.2”, “3.3.3”for the details and procedures.

- Measure a new pump performance and use the data as a baseline for evaluating pump deterioration status.
- Measure the pressure at 1000 r/min operation with the drill you select for the evaluation.
- The measured data will be automatically saved in the storage area on the circuit board.
- The measurement of new pump performance should be performed only when the pump is newly installed or replaced.

* Accurate evaluation could not be done if the pump selected for setting a new baseline has already deteriorated.

③ Evaluation ***See “3.3.2”, “3.3.4”for the details and procedures

- To find out the progress of your pump deterioration, the evaluation will be carried out based on the baseline created by initial (new pump) performance.
- Your current pump status will be compared with the performance when pump is new at 1000 r/min operation.
- Warning signal will be tuned ON when the pressure has decreased to below 60% of its initial (new pump) performance.
- TAZUNA’s normal output signal will be turned OFF when the pressure decreases to below 40% of its initial (new pump) performance.

***Selection of a drill to establish a baseline for the evaluation**

The table below shows the suitable number of drill holes and diameters sorted by NOP coolant unit model.

Table 7

NOP coolant unit model	Pressure (MPa)	1 hole (mm)		2 holes (mm)	
		Min.	Max.	Min.	Max.
ET208*	1.0 t 1.8	1.6	2.2	1.1	1.5
ET216	1.0 to 1.8	2.4	3.1	1.7	2.2
EP008	1.0 to 5.0	1.7	2.6	1.2	1.8
EP010	1.0 to 5.0	1.8	2.8	1.3	2.0
EP014	1.0 to 5.0	2.1	3.3	1.5	2.4
EP016 (7.0 MPa)	1.0 to 5.0	2.3	3.6	1.6	2.5
EP016 (3.5 MPa)	1.0 to 2.5	2.8	3.6	2.0	2.5

* ET208 must be operated within 1.5 MPa.

The drill for setting a baseline and the evaluation must be selected within the range from max. to min. listed on “ Table 7”. One example of 1hole is a cupper pipe.

3. 3. 2 DIP Switch Setting (Evaluation for Pump Deterioration)

If you use the Pump Deterioration Alarm function, set the switch pattern as shown on "Figure 22".

*This setting is necessary either for measuring initial (new pump) performance or evaluating current pump status.

・SW5 (DipSW 1) = **ON** : When pressure control mode is OFF, the system recognizes that the sensor is not connected.

・SW11 (DipSW 7) = **ON** : Turn the Switch pattern ON to activate the Pump Deterioration Alarm mode.

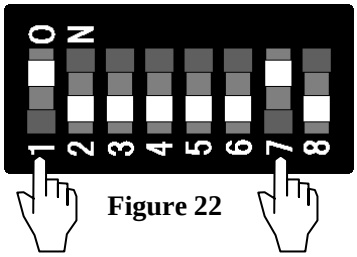


Figure 22

3. 3. 3 Steps to Establish a Baseline

① For creating a new baseline, set the switch pattern as "Figure 23" so that the system could initiate measurement of the initial (new pump) performance.

・SW12 (DipSW 8) = **ON** : Baseline Setting mode

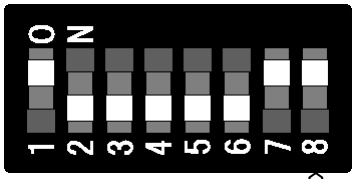


Figure 23

② Turn ON both the Pump Deterioration Alarm Mode (DI 8) and Center Through Command (DI 2) to initiate the measurement of initial (new pump) performance.

*When the measurement is completed, lighting pattern like No. 10 in "Figure 28" will be displayed with LED lights.

3. 3. 4 How to Perform the Current Pump Status Evaluation

Set the switch pattern as "Figure 24" to start the pump evaluation by comparing the current pump status with the initial (new pump) performance.

・SW12 (DipSW 8) = **OFF** : Turn OFF the Baseline setting mode

*Turn OFF the Baseline Setting mode once a new baseline is created.

As the evaluation could not start if the switch pattern remains in ON position. To start the evaluation, also make sure that both the Pump Deterioration Alarm mode (DI8) and the Center Through Command (DI2) are ON.

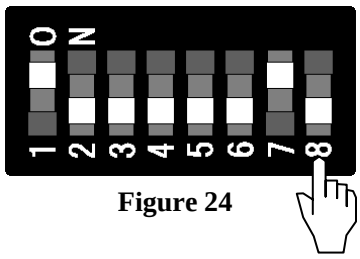


Figure 24

<Caution>

The evaluation could not start, if NOP coolant unit model indicated on SW3 (RotSW3) is not the one you originally use when establishing the baseline.

Be sure to use the same drill as you originally use for establishing the baseline whenever the evaluation is performed. If the drill could no longer be used due to a damage or rust, select exactly the same drill model type. Proper evaluation could not be done if a drill with different specification is used.

3. 3. 5 Baseline for the Evaluation and Result

Your current pump deterioration status is evaluated by compared with initial performance of the pump. If the current performance drops to below 60% of its initial (new pump) performance, alarming signal (DO4 ON) will be turned ON, which is indicated with LED lights. When the current performance drops to less than 40% of its initial (new pump) performance, TAZUNA normal output signal (DO1) will be turned OFF and the pump operation stops accordingly.

3. 4 List of PQroid (Drill Identification System) SW Assignment

3. 4. 1 Rotary Switch 1 to 4（SW1 to SW4）

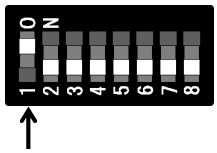
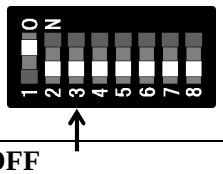
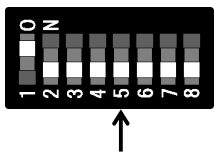
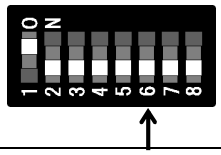
Table 8

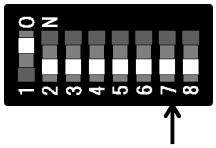
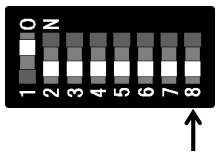
<table>
<tr><th>Name</th><th colspan="4">Function</th><th>Default</th></tr>
<tr><td rowspan="18">SW1 (0 to F)
RotSW1</td><td colspan="4">Fixed pressure setting
Pressure is fixed at constant rate.
*This setting is intended to machine work pieces under fixed constant pressure, regardless of drill hole diameters or the evaluation result.</td><td rowspan="18">0</td></tr>
<tr><td></td><td>Set pressure (2 MPa Spec.)</td><td>Set pressure (3.5/7 MPa Spec.)</td><td>No pressure control</td></tr>
<tr><td>0</td><td>M code</td><td>M code</td><td>N/A</td></tr>
<tr><td>1</td><td>0.2 MPa</td><td>0.5 MPa</td><td>1000 min-1</td></tr>
<tr><td>2</td><td>0.4 MPa</td><td>1.0 MPa</td><td>1100 min-1</td></tr>
<tr><td>3</td><td>0.6 MPa</td><td>1.5 MPa</td><td>1200 min-1</td></tr>
<tr><td>4</td><td>0.8 MPa</td><td>2.0 MPa</td><td>1300 min-1</td></tr>
<tr><td>5</td><td>1.0 MPa</td><td>2.5 MPa</td><td>1400 min-1</td></tr>
<tr><td>6</td><td>1.2 MPa</td><td>3.0 MPa</td><td>1500 min-1</td></tr>
<tr><td>7</td><td>1.4 MPa</td><td>3.5 MPa</td><td>1600 min-1</td></tr>
<tr><td>8</td><td>1.6 MPa</td><td>4.0 MPa</td><td>1700 min-1</td></tr>
<tr><td>9</td><td>1.8 MPa</td><td>4.5 MPa</td><td>1800 min-1</td></tr>
<tr><td>A</td><td>2.0 MPa</td><td>5.0 MPa</td><td>1900 min-1</td></tr>
<tr><td>B</td><td>N/A</td><td>5.5 MPa</td><td>2000 min-1</td></tr>
<tr><td>C</td><td>N/A</td><td>6.0 MPa</td><td>N/A</td></tr>
<tr><td>D</td><td>N/A</td><td>6.5 MPa</td><td>N/A</td></tr>
<tr><td>E</td><td>N/A</td><td>7.0 MPa</td><td>N/A</td></tr>
<tr><td>F</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td rowspan="18">SW2 (0 to F)
RotSW2</td><td colspan="3">Machining pressure offset adjustment
Selected pressure value will be equally added to the each pressure set by the Drill Identification Data Table. The pressure never exceeds the range of specifications (2.0 MPa/7.0 MPa).</td><td rowspan="18">7</td></tr>
<tr><td></td><td>Set pressure (2 MPa Spec.)</td><td>Set pressure (3.5/7 MPa Spec.)</td></tr>
<tr><td>0</td><td>-1.0 MPa</td><td>-3.0 MPa</td></tr>
<tr><td>1</td><td>-0.6 MPa</td><td>-2.0 MPa</td></tr>
<tr><td>2</td><td>-0.5 MPa</td><td>-1.5 MPa</td></tr>
<tr><td>3</td><td>-0.4 MPa</td><td>-1.0 MPa</td></tr>
<tr><td>4</td><td>-0.3 MPa</td><td>-0.5 MPa</td></tr>
<tr><td>5</td><td>-0.2 MPa</td><td>-0.2 MPa</td></tr>
<tr><td>6</td><td>-0.1 MPa</td><td>-0.1 MPa</td></tr>
<tr><td>7</td><td>±0 MPa</td><td>±0 MPa</td></tr>
<tr><td>8</td><td>+0.1 MPa</td><td>+0.1 MPa</td></tr>
<tr><td>9</td><td>+0.2 MPa</td><td>+0.2 MPa</td></tr>
<tr><td>A</td><td>+0.3 MPa</td><td>+0.5 MPa</td></tr>
<tr><td>B</td><td>+0.4 MPa</td><td>+1.0 MPa</td></tr>
<tr><td>C</td><td>+0.5 MPa</td><td>+1.5 MPa</td></tr>
<tr><td>D</td><td>+0.6 MPa</td><td>+2.0 MPa</td></tr>
<tr><td>E</td><td>+1.0 MPa</td><td>+3.0 MPa</td></tr>
<tr><td>F</td><td>+2.0 MPa</td><td>+4.0 MPa</td></tr>
</table>

Name		Function	Default
SW3 (0 to F) **RotSW3**	**NOP coolant unit model selection** Select the NOP coolant unit model you use.		**5**
	0	NOP coolant unit -ET208（750 W type）* 2.0 MPa	
	1	NOP coolant unit -ET208（1.5 kW type）2.0 MPa	
	2	NOP coolant unit -ET216（750 W type）2.0 MPa	
	3	NOP coolant unit -ET216（1.5 kW type）2.0 MPa	
	4	NOP coolant unit -EP008（2.2 kW type）7.0 MPa	
	5	NOP coolant unit -EP010（2.2 kW type）7.0 MPa	
	6	NOP coolant unit -EP014（3.7 kW type）7.0 MPa	
	7	NOP coolant unit -EP016（3.7 kW type）7.0 MPa	
	8	NOP coolant unit -EP016（2.2 kW type）3.5 MPa	
	9	N/A	
	A	*ES208(750kW type) must be operated within 1.5 MPa.	
	B		
	C		
	D		
	E		
	F		
SW4 (0 to F) **RotSW4**	**Evaluation delay setting** You can set the time, starting from the Center Through Command, coolant flowing through the pipe, finally reaching the drill until the flow rate is stable and ready for the evaluation. Be sure to set the optimal time considering the pipe diameter, pipe length ranging from the check valve to the drill as well as fluid viscosity as the time is subject to these factors. The reliable evaluation result may not be obtainable if the time is too short. And machining starts too late if the time is too long. *Example: If the internal diameter of the pipe is 20 mm and 3 m long, it will take approx. 0.6s.		**4**
	0	0.2 s	
	1	0.3 s	
	2	0.4 s	
	3	0.5 s	
	4	0.6 s	
	5	0.7 s	
	6	0.8 s	
	7	0.9 s	
	8	1.0 s	
	9	1.1 s	
	A	1.2 s	
	B	1.3 s	
	C	1.4 s	
	D	1.5 s	
	E	N/A	
	F		

3．4．2 DIP Switch1 to 8 (SW5 to SW12）

Table 9

Name	Function		Default setting
SW5 (ON/OFF) DipSW1	**Pressure control mode** Enable/Disable the Pressure control mode. If enabled, the pressure is controlled in the Drill identification control mode, and when DI3, Set Pressure Mode, is ON, pressure is controlled at a constant rate.		**ON** 
	OFF	Disable (No pressure control) *Running a motor at constant rotational speed set by SW1.	
	ON	Enable (Pressure is controlled)	
SW6 (ON/OFF) DipSW2	**Unused**		**OFF** 
	OFF		
	ON		
SW7 (ON/OFF) DipSW3	**Filter Clogging Alarm mode** Enable/disable filter Clogging Alarm mode. If enabled, alarm signal is output when the system detects clogging in Turbulence. The system detects clogging when the pressure on suction side drops to -0.05 MPa or less. * It is required to install pressure sensor on the suction side. Use analog input 2 (AI2) to connect the sensor.		**OFF** 
	OFF	Disable (No alarming)	
	ON	Enable (Clogging will be alarmed)	
SW8（ON/OFF) DipSW4	**Unused**		**OFF** 
	OFF		
	ON		
SW9 (ON/OFF) DipSW5	**TAZUNA normal signal (DO1) inversion setting** You can invert the signal form of TAZUNA normal signal output DO1. Select this one according to the specification of your input side.		**OFF** 
	OFF	Signal is ON when operating in normal state (NC)	
	ON	Signal is OFF when operating in normal state (NO）	
SW10 (ON/OFF) DipSW6	**Unused**		**OFF** 
	OFF		
	ON		

Switch No.	Function		Default
SW11（ON/OFF） DipSW7	**Pump Deterioration Alarm mode** Enable/disable pump Deterioration Alarm mode. See section 3. 3 Pump Deterioration Alarm Function for further details.		OFF 
	OFF	Disable	
	ON	Enable	
SW12（ON/OFF） DipSW8	**Baseline setting mode** Enable this setting when creating a new baseline for the current pump status evaluation. Once the measurement is completed, be sure to turn this switch back to OFF position. If without turning the switch back to OFF position, the system might not function properly. Alarm signal will be output when your current pump performance drops to below a certain degree compared with the new pump performance. If further performance decrease is observed, the system recognizes it as an abnormal sign and the TAZUNA normal signal will be turned OFF. (It remains in ON position when SW9 is ON)		OFF 
	OFF	Disable (Normal operation)	
	ON	Enable (Start masuring of new product performance)	

3. 5 PQroid (Drill Identification System) Interface Signal List

Table 10

	I/O symbol	Name	Description	Terminal port
Digital input	**DI1**	**NC Machine Ready**	Keep the signal ON when the machine is ready for the operation, and turn it OFF when TAZUNA abnormal signal is indicated.	CN6-1
	DI2	**Center Through Command**	Keep the signal ON during the center through operation, and turn it OFF when the operation ends. The signal initiates the Drill Identification Control Mode.	CN6-2
	DI3	**Set Pressure Mode**	This setting is intended to control the pressure at your target constant rate instead of controlling in Drill Identification Control mode. When this mode is selected, be sure to keep DI3 ON while the Center through command is output. The pressure is controlled at constant rate set by the combination of DI5, DI6 and DI7 signals	CN6-3
	DI4	**Inverter Normal**	Keep the signal ON while the inverter is operating normally *If turned OFF in the middle of operation, it will be recognized as a sign of abnormality and control mode will be stopped accordingly.	CN4-1
	DI5	**Pressure Reference 0**	The pressure is controlled at constant rate set by the combination of DI5, DI6 and DI7 signals. See “Table 11”.	CN6-7
	DI6	**Pressure Reference 1**	The pressure is controlled at constant rate set by the combination of DI5, DI6 and DI7 signals. See “Table 11”.	CN6-8
	DI7	**Pressure Reference 2**	The pressure is controlled at constant rate set by the combination of DI5, DI6 and DI7 signals. See “Table 11”.	CN6-9
	DI8	**Pump Deterioration Alarm Mode**	Keep the signal ON when necessary to evaluate the current pump deterioration status. Your pump status will be evaluated based on the new pump performance.	CN6-10

▪Set pressure Table

The “Table 11” below describes the combination patterns of Digital Input 5 (DI5), Digital Input 6 (DI6), Digital Input 7 (DI7) and their corresponding set pressures.

Table 11

DI_7: bit2	DI_6: bit1	DI_5: bit0	Decimal Value	Discharge pressure	
				2 MPa Spec.	7 MPa Spec.
ON	**ON**	**ON**	7	2.0 MPa	7.0 MPa
ON	**ON**	OFF	6	1.8 MPa	6.0 MPa
ON	OFF	**ON**	5	1.6 MPa	5.0 MPa
ON	OFF	OFF	4	1.4 MPa	4.0 MPa
OFF	**ON**	**ON**	3	1.2 MPa	3.5 MPa
OFF	**ON**	OFF	2	1.0 MPa	3.0 MPa
OFF	OFF	**ON**	1	0.8 MPa	2.5 MPa
OFF	OFF	OFF	0	0.6 MPa	2.0 MPa

* The pressure is automatically maintained at the Pressure Reference Input (DI5 to 7) values during the Set Pressure mode (DI3) even in the middle of center through operation.
You cannot change the control method, <Set Pressure mode ⇔ Drill Identification Control mode>, during the center through operation.

Table 12

	I/O symbol	Name	Description	Terminal port
Digital Output	**DO1**	**TAZUNA Normal Operation**	ON signal is output the whole time when TAZUNA and inverter are operating normally. Use the signal as a sign of a NC side abnormality. You can reset the setting by turning OFF NC Machine Ready signal when any abnormality is detected. *Signal form can be inverted with SW9	CN6-4
	DO2	**Center Through Command**	ON signal is output once the system receives the Center Through Command and coolant pressure reaches set pressure. OFF signal will be output when center through operation ends.	CN6-5
	DO3	**Run Motor Command**	Output the Run Motor Command to the inverter.	CN4-2
	DO4	**Deterioration Warning***	The signal is turned ON when the system detects pressure drop to below the 60% of its baseline pressure.	CN6-5
		Filter Clogging Alarm*	The signal is output when the system detects clogging in Turbulence™ Filter. The signal will be turned ON when pressure reaches -0.04MPa on pressure sensor AI2. *It is required to install an additional pressure sensor to AI2.	
Analog Input	**AI1**	**Pressure Sensor 1**	Input to pump pressure sensor. *A sensor to control pressure.	CN2-1, 2, 3
	AI2	**Pressure Sensor 2**	Input to a sensor for detecting the clogging in Turbulence™ Filter *Only available when SW7 (DipSW3) is ON).	CN2-4, 5, 6
Analog Output	**AO1**	**Rotational Speed Command**	Output rotational speed command to inverter.	CN3-1, 2
	AO2	**Discharge Pressure Signal**	Output/input value directly from the Pressure Sensor (AI1).	CN5-1, 2

* Filter Clogging Alarm mode is unavailable when pump Deterioration Alarm mode is enabled.

3. 6 PQroid (Drill Identification System) Time Chart

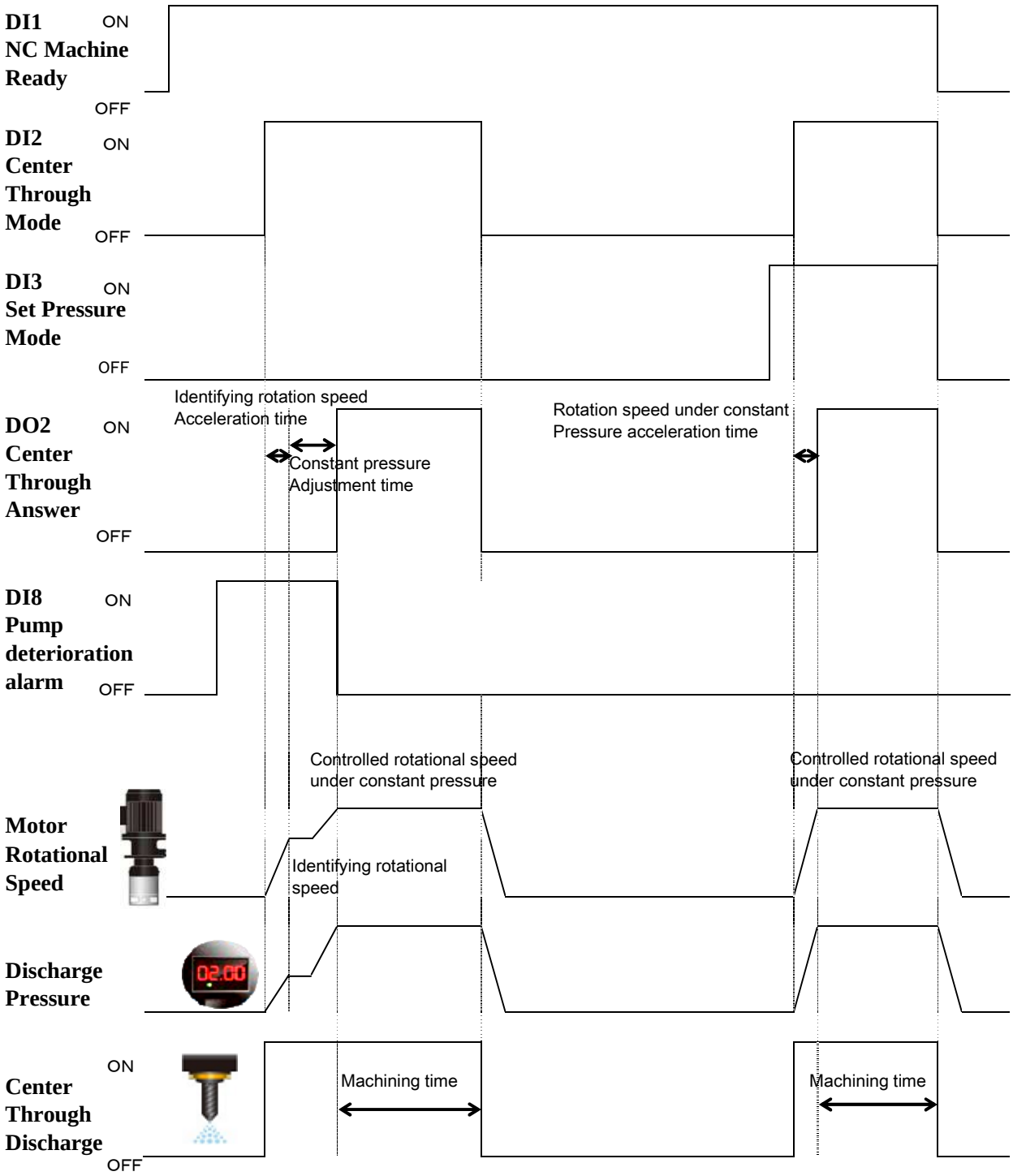


Figure 25

3. 7 PQroid (Drill Identification System) Alarm

When the PQroid detects alarming signals, the alarming status will be indicated by blinking the RUN LED and ERR LED.

3. 7. 1 Alarm Signal Indicating Patterns

"Figure 28" shows each alarming status and corresponding blinking pattern.
For further details of alarming status, see the next section 3.7.2 Description of Alarm Signals and Corrective Actions.

* ① represents RUN LED (LED Green), ② represents ERR LED (LED Red) in "Figure 28"
* See "Figure 26" for the locations on the circuit board. .

TAZ-111 RUN/ERR LED Indications

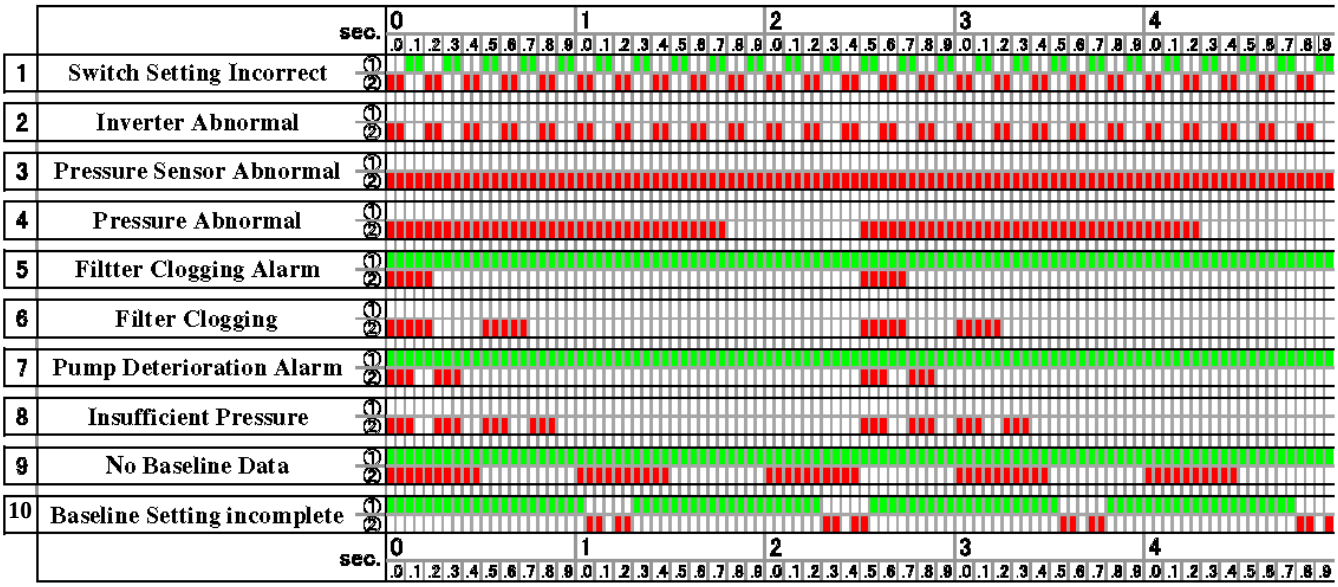


Figure 28

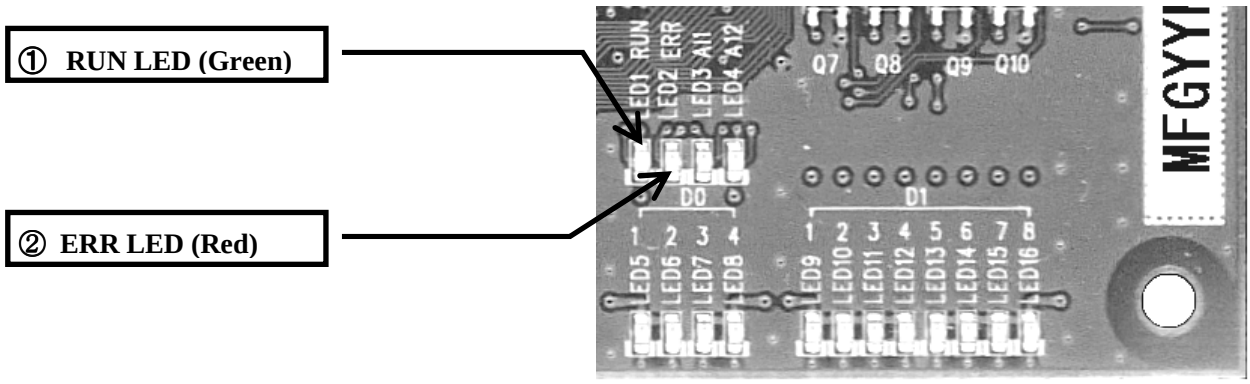


Figure 26

3. 7. 2 Description of Alarm Signals and Corrective Action

" Table 13" shows meaning of each alarming signals, the cause and corrective action.

Table 13

1) Switch Setting Incorrect		
Status	Cause	Corrective action
Rotary switch is in the unused position.	Rotary switch setting incorrect.	Change the rotary switch position to the operating mode.
2) Inverter Abnormal		
Status	Cause	Corrective action
Normal inverter signal breaks off	Signal cable from inverter is cut off (or disconnected)	Check for signal cable being cut off or disconnected.
	Inverter abnormal signal	Check for the problem cause from alarm list described on your inverter user manual and take necessary actions.
3) Pressure Sensor Abnormal		
Status	Cause	Corrective action
The system detects current drop to below 4.001 mA in pressure sensor input.	Improper setting of pressure sensor	Check the pressure sensor setting.
		Perform zero reset on atmospheric pressure correction of pressure senor.
	Pressure sensor failure or cable disconnection.	Check for the sensor failure or cable disconnection.
	Negative pressure detection (Air suction)	Check for the pump clogging or pump leakage.
4) Abnormal Pressure		
Status	Cause	Corrective action
Pressure exceeds the specified value See the specified value for each model below. ・2MPa spec. = 2.5 MPa ・3.5MPa spec. = 4.0 MPa ・7MPa spec. = 8.0 MPa	Incorrect setting of pressure sensor.	Check the pressure sensor setting.
	Pressure sensor failure.	Check for the pressure sensor failure.
	Clogging of outlet port and the other areas.	Check the outlet port or the nearby areas.
5) Filter Clogging Alarm		
Status	Cause	Corrective action
The system detects suction pressure drop to -0.04 MPa or less. *The "Filter Clogging Alarm" only functions when the Filter Clogging Alarm mode is enabled [SW7=ON]. Operation will never be stopped with the alarming.	Pressure sensor setting incorrect.	Check the pressure sensor setting.
	Pressure sensor failure	Check for the pressure sensor failure.
	Clogging in Turbulence™ filter.	Perform back-washing on Turbulence™ filter to clear the clogging.

6) Filter Clogging

Status	Cause	Corrective action
The system detects the suction pressure drop to 0.05 MPa or less. *The ”Filter Clogging” only functions When the Filter Clogging Alarm mode is enabled [SW7=ON].	Incorrect pressure sensor setting.	Check the pressure sensor setting.
	Clogging in Turbulence™ filter.	Perform back-washing on Turbulence™ filter to clear the clogging.

7) Pump Deterioration Alarm

Status	Cause	Corrective action
Pump detects 60% of its performance drops from the pump initial (new product) performance（the “Pump Deterioration Alarm” only functions when enabled [SW11=ON]. Operation will never be stopped with the alarming.	Leakage from pipes in outlet line.	Check for the leakage from the pipes around outlet port or connected areas.
	Air suction	Check the liquid level decrease or bubbling of the liquid for air suction.
	Wrong drill attached to the machine for the evaluation.	Check whether the attached drill is the one originally used for baseline setting.
	If none of the above applies, pump might have already deteriorated.	It might be the time to replace with a new pump.

8) Insufficient Pressure

Status	Cause	Corrective action
The system can detect when the pressure drops to below 40% of its initial (new pomp) performance.（The ”Insufficient pressure” only functions when the Pump Deterioration Alarm mode is enabled [SW11=ON].	Leakage from pipes in outlet line.	Check for the leakage from pipes around outlet port or connected areas.
	Air suction	Check for the air suction due to water level decrease or bubbling of coolant liquid.
	Wrong drill attached to the machine for the evaluation.	Check whether the attached drill is the one originally used for baseline setting.
	If none of the above applies, pump might have already deteriorated.	It might be the time to replace with a new pump.

9) No Baseline Data

Status	Corrective action
The system is still in the Pump Deterioration Alarm mode [SW11=ON] when no baseline data exists.	Turn the setting [SW11] OFF or measure the new pump performance.

10) Baseline Setting Incomplete

Status	Corrective action
Baseline setting mode The Baseline setting mode is still enabled [SW12=ON] even when performance baseline already exists.	Turn the Baseline setting mode back to OFF. (If you need to reset the baseline to create a new one for some reasons, turn the setting OFF first before turning it back to ON）

4 Warranty

4. 1 Warranty

Warranty period

The new product is warranted for a period of one year from the date of delivery to customer's designated place or 5000 hours of operation, whichever occurs first. The warranty period may not apply if the product longevity is affected by use environment, condition and frequency.

Warranty coverage

The warranty is void if the product has not been operated within the specifications or in a manner specified in this "User's Manual".

The warranty provided herein doesn't cover:

- Damages caused by usage, environment or storage under inappropriate condition or misuse negligent acts, the flaw of final system design into which TAZUNA is incorporated by the customer or the user.
- Any alternation or modification made to the product by the customer or the user.
- Damages caused by use outside of the product's specifications or any external causes.
- Damages caused by factors other than the product itself, such as natural disaster, act of God, or any damages outside of our reasonable control.
- Damages caused by wrapping or fumigation.
- Expired warranty period.
- Damages or malfunctions caused by running programs designed by the customer or the user

The warranty only covers this product so Nippon Oil Pump Co., Ltd. is not liable for any collateral damages caused by the product failure.

This product or its component is subject to change without notice.

Appendix

Appendix. 1 Default Inverter Parameters of TAZUNA

The YASKAWA Electronics V1000 is adopted as a standard inverter for TAZUNA, and set the following part of parameters before we ship out.

* If you purchase the inverter of YASKAWA Electronics V1000 on your own, be sure to change the parameters from the default setting as shown on "Table 14".

・Standard configuration (Common setting) of TAZUNA system's inverter (YASUKAWA V1000) parameters.

Table 14

No.	Description	Set value	Unit	Default
b1-07	Local/Remote Run Selection	1	-	0
b1-17	Run Command at Power Up	1	-	0
C1-01	Acceleration time 1	0.2	sec	10.0
C1-02	Deceleration time 1	0.2	sec	10.0
C6-02	Carrier frequency selection	0002	-	0007
d1-17	Jog frequency reference	90	min^{-1}	600
E1-04	Maximum output frequency (FMAX)	133.3	Hz	60.0
E1-09	Minimum output frequency (FMIN)	1.0	Hz	1.5
H3-11	Terminal A2 gain setting	50.0	%	100.0
o1-03	Digital operator display selection	2	-	0

※An alarm can occur due to the viscosity of the liquid or pipe resistance. One possible cause is that the acceleration time setting is too short. This might be solved by extending the time. For changing the time setting, please refer to "Appendix. 2 TAZUNA acceleration time setting ".

・If you use 1.5kW motor

Table 15

No.	Description	Set value	Unit	Default
E2-01	Motor rated current	8.50	A	11.40

・If you use 750W motor

Table 16

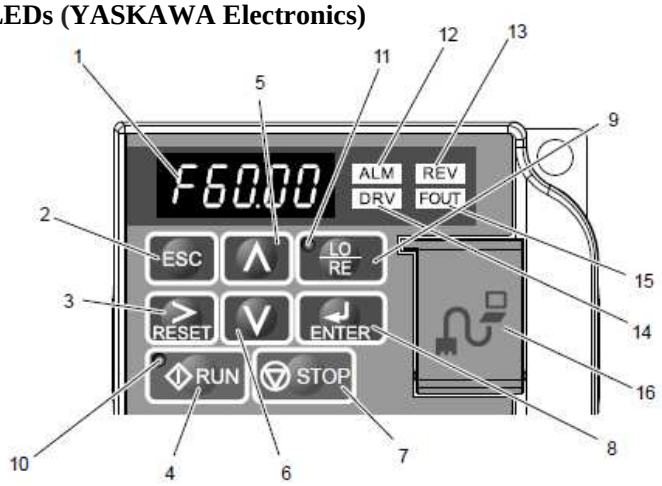
No.	Description	Set value	Unit	Default
E2-01	Motor rated current	4.90	A	11.40

The motor rated current default value doesn't need to be changed if you use either 2.2 kW or 3.7 kW motor. If using 3.7 kW motor, the compatible inverter is also 3.7kW type, and in that case the default motor rated current is 19.60 A

Appendix. 2 TAZUNA acceleration / deceleration time setting

An alarm may occur due to the overloading when the acceleration time setting is too short.
(The inverter requires more power to be activated in a short period). If so, Acceleration time setting must be changed.

Keys, Displays, and LEDs (YASKAWA Electronics)



No.	Display	Name	Function
1	F60.00	Data Display Area	Displays the frequency reference, parameter number, etc.
2	ESC	ESC Key	Returns to the previous menu.
3	RESET	RESET Key	Moves the cursor to the right. Resets the drive to clear a fault situation.
4	RUN	RUN Key	Starts the drive.
5	∧	Up Arrow Key	Scrolls up to select parameter numbers, setting values, etc.
6	∨	Down Arrow Key	Scrolls down to select parameter numbers, setting values, etc.
7	STOP	STOP Key	Stops the drive. **Note:** Stop priority circuit. Pressing the STOP key will always cause the drive to stop the motor, even when a Run command is active at an external Run command source. Set parameter o2-06 to 0 to disable the STOP key priority.
8	ENTER	ENTER Key	Selects all modes, parameters, settings, etc. Selects a menu item to move from one display screen to the next.
9	LO RE	LO/RE Selection Key	Switches drive control between the operator (LOCAL) and the control circuit terminals (REMOTE). **Note:** LOCAL/REMOTE key effective during stop in drive mode. If the digital operator could change from REMOTE to LOCAL by incorrect operation, set o2-01 (LOCAL/REMOTE Key Function Selection) to "0" (disabled) to disable LOCAL/REMOTE key.
10	RUN	RUN Light	Lit while the drive is operating the motor.
11	LO RE	LO/RE Light	Lit while the operator (LOCAL) is selected to run the drive.
12	ALM	ALM LED Light	
13	REV	REV LED Light	
14	DRV	DRV LED Light	
15	FOUT	FOUT LED Light	
16	–	Communication Port	Port used for USB Copy Unit, LCD Operator Keypad, and for connecting to a PC. **NOTICE:** *Use only specified cable when making connections to the drive. Failure to comply may damage the drive.* **NOTICE:** *Do not open the port cover wider than 90 degrees. Failure to comply may break the port cover and leave the unprotected port susceptible to damage.*

Take the following steps to adjust the acceleration time using the above keys.

① Press the STOP Key while the inverter is powered on. (RUN Light's flashing pattern changes from "flashing once" to "flashing twice")

② Press LO/RE Selection Key（RUN Light is off, LO/RE Light is on, and rotational speed will be displayed on Data Display Area.

③ Press Down Arrow key twice to display "Par" on Data Display Area, and press ENTER Key ("A1-01"will show up)

④ Use Up Arrow Key, Down Arrow Key, and RESET Key to display "C1-01" and press ENTER Key (Data Display Area will display the current value of parameter C1-01)

⑤ Use Up Arrow Key, Down Arrow Key, and RESET Key to control the value of parameter C1-01(acceleration time setting) and press ENTER Key. (Return to "C1-01"on Data Display Area)

⑥ Again, use Up Arrow Key, Down Arrow Key, and RESET Key to display "C1-02"and press ENTER Key. (Data Display Area will display the current value of parameter C1-02)

⑦ Same as the setting for C1-01, use Up Arrow Key, Down Arrow Key, and RESET Key to control the value of parameter C1-02(deceleration time setting) and press ENTER Key. (Return to "C1-02" on Data Display Area)

⑧ Press ESC Key a few times until the rotational speed is displayed on Data Display Area.

⑨ Press LO/RE Selection Key（LO/RE Light disappears and RUN Light flashes once）
Now the acceleration/deceleration time setting change has been completed.

MEMO

TAZUNA Unit：TAZ－111

PQ roid（Drill Identification System）

User’s manual

Ver. TAZ201810

30th October. 2018

Published by： **Nippon Oil Pump Co., Ltd.**

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