# PTLK Inverter

Tek Drive

# TDS-F8

## MODBUS Communication Application Manual

**Please ensure the user gets this manual, for the optimal use of this device.**

PTLK / TDS-F8 INVERTER

MODBUS Communication

## 1. Introduction:

PTLK / TDS-F8 INVERTER uses the RS-485 series communication port and Modbus protocol for connecting with a PLC. Up to 31 inverters can be monitored and controlled simultaneously by a host controller with such links.

## 2. TDS-F8 Communication specifications:

(1) Uses RS-485 series communication port for Hardware link.

(2) Communication Format: Modbus RTU mode protocol.

(3) Communication Format setting: via setting of parameters of the 9th group:

(i) Parameter (9-01) = 1~255 …Communication address (default =1)

In the Communication Format, each communication unit requires a unique address, up to 31 inverters can be linked.

(ii) Parameter (9-02) = 0~3 ------ transfer speed (default =3)

Parameter (9-02) = 0 ------ 1200 Bps

Parameter (9-02) = 1 ------ 2400 Bps

Parameter (9-02) = 2 ------ 4800 Bps

Parameter (9-02) = 3 ------ 9600 Bps

For setting RS-485 communication transfer speed

(iii) Parameter (9-03) = 0~2 ------ Parity setting (default =0)

Parameter (9-03) =0 ------ No Parity

Parameter (9-03) =1 ------ Even Parity

Parameter (9-03) =2 ------ Odd Parity

Parity format in RS-485 communication set by (9-03) .

(Note): In case of changing (9-02) or (9-03), the inverter must be switched OFF and re-started again.

(4) Other parameters related to RS-485:

(i) Setup inverter response mode during a RS-485 communication failure:

Parameter (9-04) = 0~3 ------ Inverter stop method during RS-485 communication failure (default =0)

Parameter (9-04) = 0 ------ decelerate according to (1-13)

Parameter (9-04) = 1 ------ stop by free run

Parameter (9-04) = 2 ------ decelerate according to (1-15)

Parameter(9-04) = 3 ------ continue to run (can be stopped by pressing “STOP”)

(ii) Setup Detection time for releasing alarm after a communication failure:

Parameter (9-05) = 00.0~25.5s ------ Detection time for communication failure (default =01.0s)

Parameter (9-05) = 00.0 s ------ for “No Detection” of communication failure

When the (9-05) set period elapses, the digital controller will display “ CErr ”

(iii) For setting up whether RS-485 is used for command source:

Parameter (2-01)= 2 ------ Operation Command comes from RS-485 port.

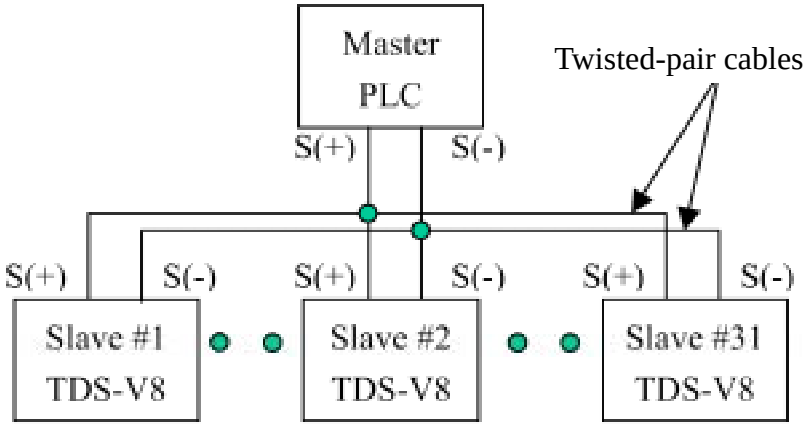
Parameter (2-02)= 2 ------ Frequency Command comes from RS-485 port.

(iv) For setting up that the signal of the inverter output terminal comes from RS-485 port.

Parameters (3-06) and (3-07) = 25 ------ signal of the Digital output terminal comes from RS-485 port.

## 3. TDS-F8 connections:

RS-485 series communication port comprises S(+) and S(-) pins for semi-duplex communication transfer. For connecting multi RS-485 ports, just series-link all the S(+)s and all the S(-)s respectively.




**RS-485 connecting diagram**

## 4. TDS-F8 connection procedures:

(1) Power ON the inverter, then setup RS-485 related parameters and connect the RS-485 cable. Communication with the controller is now enabled.

(2) During wiring the cable, if the inverter parameter setting for Operation/Frequency command comes from RS-485 port (2-01=2 or 2-02=2), if the inverter, in the STOP mode, does not receive any information in the period set by (9-05), the digital controller will display the “ CErr ” blinking message, indicating that the system is in standby for communication. On receipt of data, the blinking message will go off. During the operation, if no data comes in during the period set by (9-05), the system will respond according to the (9-04) setting, and the digital controller will display the “ CErr ” error message.

## 5. The Modbus RTU protocol:

(1) Definition of the Character:

In the Modbus RTU mode, each Character, or byte, is composed of 11 bits: 1 start bit, 8 data bits, 1 parity bit and 1 stop bit. If (9-03)=0 for “No Parity”, the parity bit shall be set “1”. The transfer carries out one by one starting from the start bit. The following are the formats of the character:

Character with parity check:

| LSB | | | | | | | | | | MSB |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Start bit | Data bit 0 | Data bit 1 | Data bit 2 | Data bit 3 | Data bit 4 | Data bit 5 | Data bit 6 | Data bit 7 | Parity bit | Stop bit |

Character without parity check:

| LSB | | | | | | | | | MSB |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Start bit | Data bit 0 | Data bit 1 | Data bit 2 | Data bit 3 | Data bit 4 | Data bit 5 | Data bit 6 | Data bit 7 | Stop bit | Stop bit |

(2) Definition of a Message:

In the Modbus RTU mode protocol, each message comprises 4 components namely Slave Address, Function Code, Data and Checking Code (CRC-16). Messages are separated with starting and ending periods equal to the length of 3.5 Characters. The message format is as follows:

| Period > length of 3.5 Characters | Communication Address (Slave Address) | Function Code | Data | Checking Code (CRC-16) | | Period > length of 3.5 Characters |
|---|---|---|---|---|---|---|
| | 1 Character | 1 Character | n Character | CRC_L | CRC_H | |

(3) Message format:

(i) Communication Address (Slave Address)

One Character-length is used for the RTU mode communication address of the inverter in the message. Parameter (9-01) is used for setting up this address, with the range of 1~31.

Message sent by the Master can be received by all Slaves, but only the one with the same Slave Address as that in the message will execute the received message, with a response sent back to the Master. When the Master sends a message with the Slave Address set as “0”, all slaves will execute the massage without sending back any response.

(ii) Function Code

One Character length is used for the RTU mode function Code in a message, for making the slave execute the command. Function Codes used by this inverter are listed as follow; each function will be detailed in “Message Mode”.

| Function Code | Function |
|---|---|
| 03H | Read data from Register |
| 06H | Write a single datum to Register |
| 08H | Loop test |
| 10H | Write data to Register |

(iii) Data

Due to different data requirements of different functions, the data bytes of different messages have different lengths; detailed discussions will be given in “Message Mode”.

(iv) Checking Code (CRC-16)

In the message format, a CRC-16 checking code of 2 characters long is used for errors in the transferred data. CRC-16 is a 16-bit binary value. When transferred, checking code of the low-byte is transferred first, then that of the high-byte. CRC-16 is operated as follows:

① Set CRC_16 as FFFFH.

② Execute XOR operation for the low-byte of the CRC_16 with the first byte of the message, send the result back to the low-byte of the CRC_16.

③ LSB of CRC_16 is 0, CRC_16 is shifted one bit to the right, with a 0 filled into the highest bit. If LSB of CRC_16 is 1, CRC_16 is shifted one bit to the right, with a 0 filled into the highest bit, and than execute XOR with A001H.

④ Repeat step ③ until shifting to the right 8 times.

⑤ Repeat steps ②~④ for the next byte of the message, until all bytes are done.

The final CRC_16 value is the check code of the CRC_16.

Use Basic to run CRC_16, for example:

```
Function CRC_16(message$) as long
crc16& = 65535
FOR CHAR% = 1 to LEN (message$)
    crc16& = crc16& XOR ASC (MID$ (message$, CHAR%, 1))
    FOR BIT% = 1 to 8
        IF crc16& MOD 2 THEN
           crc16& = (crc16& \ 2) XOR 40961
        ELSE
           crc16& = crc16& \ 2
        END IF
    NEXT BIT%
NEXT CHAR%
crc_hi% = crc16& \ 256
crc_lo% = crc16& MOD 256
message$ = message$ + CHR$(crc_lo%) + CHR$(crc_hi%)
CRC_16 = crc16&
END FUNCTION CRC_16
```

(4) Message mode:

Messages are divided into commands and responses. Messages send from Master to a Slave is a Command, the respond send back to Master by a Slave is a Response. In general conditions, after 5ms a Command will be responded by the Slave with the denoted address. No response will be given by any Slave for the following conditions:

① The “Slave Address” in the Commend does not match with any of the linked Slaves.

② An error is detected when the Slave receives the message (Parity, Framing, Overrun, or CRC-16 error).

## 6. TDS-F8 message format

TDS-F8 Inverter accepts only 3 types of command messages: Read data from (03H), Loop Test (08H) and Write data to (06H and 10H). See the following table:

| Command | Function Code | Function | Host Query | | Inverter return | |
|---|---|---|---|---|---|---|
| | | | Byte (Min.) | Byte (Max.) | Byte (Min.) | Byte (Max.) |
| Data Read | 03H | Read data from Holding Register | 8 | 8 | 7 | 37 |
| Data Write | 06H | Write a single datum to Register | 8 | 8 | 8 | 8 |
| Loop Test | 08H | Loop test | 8 | 8 | 8 | 8 |
| Data Write | 10H | Write data to Register | 11 | 41 | 8 | 8 |

Command and Inverter return formats acceptable to the Inverter:

(1) Read command (03H):

Read data from Register. Data of a maximum of 16 registers can be read at a time.

Command message

| Slave Address | | 01H |
|---|---|---|
| Function Code | | 03H |
| Head Address | High Byte | 00H |
| | Low Byte | 20H |
| Access Count | High Byte | 00H |
| | Low Byte | 01H |
| CRC-16 | High Byte | 85H |
| | Low Byte | C0H |

Inverter Return (Error Detected)

| Slave Address | | 01H |
|---|---|---|
| 80H + Function Code | | 83H |
| Error code | | 02H |
| CRC-16 | High Byte | 01H |
| | Low Byte | 31H |

Inverter Return (Normal)

| Slave Address | | 01H |
|---|---|---|
| Function Code | | 03H |
| Data Byte Count | | 02H |
| Head Address | High Byte | 08H |
| | Low Byte | 02H |
| CRC-16 | High Byte | 3EH |
| | Low Byte | 45H |

(2) Write command (06H):

Writes datum to a holding register. If the Slave Address in the Write Command is set to 0, all Slaves on-line will receive and execute this message, but this can only be used for setting register addresses 0000H and 0001H. No response will be made by any Slave. If Write Command is used for changing parameters, the change is not saved into EEPROM when the machine is switched off. For saving into EEPROM, it must be written into address 0600H.

Host Query

| | | |
|---|---|---|
| Slave Address | | 01H |
| Function Code | | 06H |
| Head Address | High Byte | 00H |
| | Low Byte | 01H |
| Data character byte | High Byte | 00H |
| | Low Byte | 20H |
| CRC-16 | High Byte | D9H |
| | Low Byte | D2H |

Inverter Return (Error Detected)

| | | |
|---|---|---|
| Slave Address | | 01H |
| 80H + Function Code | | 86H |
| Error Code | | 03H |
| CRC-16 | High Byte | 02H |
| | Low Byte | 61H |

Inverter Return (Normal)

| | | |
|---|---|---|
| Slave Address | | 01H |
| Function Code | | 06H |
| Head Address | High Byte | 00H |
| | Low Byte | 01H |
| Data character byte | High Byte | 00H |
| | Low Byte | 20H |
| CRC-16 | High Byte | D9H |
| | Low Byte | D2H |

(3) Loop Test Command (08H):

Check if communication circuit is normal

| | | |
|---|---|---|
| Slave Address | | 01H |
| Function Code | | 08H |
| Test Code | High Byte | 00H |
| | Low Byte | 00H |
| Test Data | High Byte | 12H |
| | Low Byte | 34H |
| CRC-16 | High Byte | EDH |
| | Low Byte | 7CH |

Inverter Return (Error Detected)

| | | |
|---|---|---|
| Slave Address | | 01H |
| 80H + Function Code | | 88H |
| Error Code | | 03H |
| CRC-16 | High Byte | 06H |
| | Low Byte | 01H |

Inverter Return (Normal)

| | | |
|---|---|---|
| Slave Address | | 01H |
| Function Code | | 08H |
| Test Code | High Byte | 00H |
| | Low Byte | 00H |
| Test Data | High Byte | 12H |
| | Low Byte | 34H |
| CRC-16 | High Byte | EDH |
| | Low Byte | 7CH |

(4) Write Command (10H):

Writes multiple data to holding register. A maximum of 16 registers can be written at a time. If the Slave Address of the Write Commend is set to 0, all Slaves on-line will receive and execute this message, but this can only be used for setting register addresses 0000H and 0001H. No response will be made by any Slave. If Write Command is used for changing parameters, the change is not saved into EEPROM when the machine is switched off. For saving into EEPROM, it must be written into address 0600H.

Host Query

| | | |
|---|---|---|
| Slave Address | | 01H |
| Function Code | | 10H |
| Head Address | High Byte | 00H |
| | Low Byte | 01H |
| Access Count | High Byte | 00H |
| | Low Byte | 01H |
| Data byte Count* | | 02H |
| The first data character byte | High Byte | 00H |
| | Low Byte | 30H |
| CRC-16 | High Byte | A7H |
| | Low Byte | 95H |

Inverter Return (Error Detected)

| | | |
|---|---|---|
| Slave Address | | 01H |
| 80H + Function Code | | 90H |
| Error Code | | 03H |
| CRC-16 | High Byte | 0CH |
| | Low Byte | 01H |

Inverter Return (Normal)

| | | |
|---|---|---|
| Slave Address | | 01H |
| Function Code | | 10H |
| Head Address | High Byte | 00H |
| | Low Byte | 01H |
| Access Count | High Byte | 00H |
| | Low Byte | 01H |
| CRC-16 | High Byte | 50H |
| | Low Byte | 09H |

* Number of data bytes is 2 times of Access Count.

## 7. TDS-F8 Registers:

There are 3 types of registers: Control, Monitor and Inverter Parameters:

| Register Type | Register Property | Register Address |
|---|---|---|
| Control Data | Read/Write | 0000H~000FH |
| Monitor Data | Read-only. Non-Writeable | 0020H~002FH |
| Inverter Parameter Data | Read/Write | 0100H~0600H |

(1) Control Data register (Read/Write): Register for controlling inverter operation

List of Control Data Registers

| Address | Bits | Function Description |
|---|---|---|
| 0000H (*1) | 0 | 0: STOP; 1: RUN |
| | 1 | 0: Forward; 1: Reverse |
| | 2 | External Fault (0: disable; 1: enable) |
| | 3 | Fault Reset (0: disable; 1: enable) |
| | 4~7 | Reserved |
| | 8 | 0: disable; 1: switch from PRG mode to DRV mode, auto clear to 0 |
| | 9 | 0: disable; 1: switch from DRV mode to PRG mode, auto clear to 0 |
| | 10~15 | Reserved |
| 0001H(*1) | Frequency Command: 7530H /100% (30000/100%); 100% =(1-03) | |
| 0002H~0006H | Reserved | |
| 0007H | 0 | Output terminal Ra-Rb-Rc output setting; 0: disable; 1: enable |
| | 1 | Output terminal MO+-MO- output setting; 0: disable; 1: enable |
| | 2~15 | Reserved |
| 0008H~000FH | Reserved | |

*1. This control data register can be used for Slave Address “0” write-in message.

(2) Monitor Data Register (Read-only. Non-Writeable): For monitoring Inverter operation status

List of Monitor Data Registers

| Address | Bits | Function Description |
|---|---|---|
| 0020H | 0 | 0: STOP; 1: RUNNING |
| | 1 | 1: Zero Speed |
| | 2 | 0: Forward; 1: Reverse |
| | 3 | 1: Inverter Ready |
| | 4 | 0: PRG mode; 1: DRV mode |

| | | |
|---|---|---|
| | 5 | Reserved |
| | 6 | 1: Inverter Alarm |
| | 7 | 1: Inverter Fault |
| | 8 | Reserved |
| | 9 | |
| | 10 | |
| | 11 | |
| | 12 | 0001: Parameter Setting Invalid<br>0010: Multi-Function Digital Input Parameter Setting Invalid<br>0011: Auto-Run Mode Parameter Setting Invalid<br>0100: V/F Pattern Parameter Setting Invalid<br>0101: Frequency Limited Parameter Setting Invalid<br>0110: Jump Frequency Parameter Setting Invalid<br>0111~1111: Reserved |
| | 13 | |
| | 14 | |
| | 15 | |
| 0021H | 0 | 1: Under Voltage Fault (UV1) |
| | 1 | 1: Over Current Fault (OC) |
| | 2 | 1: Over Voltage Fault (OV) |
| | 3 | 1: Over heat Fault (OH) |
| | 4 | 1: Motor Over Load Fault (OL1) |
| | 5 | 1: Inverter Over Load Fault (OL2) |
| | 6 | 1: Output Over Torque Fault (OL3) |
| | 7 | Reserved |
| | 8 | 1: External Fault MI2 (EF2) |
| | 9 | 1: External Fault MI3 (EF3) |
| | 10 | 1: External Fault MI4 (EF4) |
| | 11 | 1: External Fault MI5 (EF5) |
| | 12 | 1: EEPROM Fault |
| | 13 | 1: CPU A/D Fault |
| | 14 | 1: Ground Fault (GF) |
| | 15 | Reserved |
| 0022H | 0 | Reserved |
| | 1 | |
| | 2 | 1: Braking Resistor Over Heat Alarm |
| | 3 | 1: RS-485 Communication transfer Alarm |
| | 4 | 1: PID Alarm |
| | 5~15 | Reserved |
| 0023H | 0 | 1: Under Voltage Alarm (UV) |
| | 1 | 1: Over Voltage Alarm (OV) |
| | 2 | 1: Over Heat Alarm (OH) |

| | | |
|---|---|---|
| | 3 | 1: Over Torque Alarm (OL3) |
| | 4 | 1: Two Line Terminal 1,2 External Alarm (EF) |
| | 5 | 1: Base Block Alarm (bb) |
| | 6 | 1: EEPROM Alarm |
| | 7 | Reserved |
| | 8 | |
| | 9 | |
| | 10 | |
| | 11 | 1: Braking Resistor Over Heat Alarm |
| | 12 | 1: RS-485 Communication Alarm |
| | 13 | Reserved |
| | 14 | 1: PID Alarm |
| | 15 | Reserved |
| 0024H | Frequency Command (30000/100%) 100%=(1-03) | |
| 0025H | Output Frequency (30000/100%) 100%=(1-03) | |
| 0026H | Output Voltage 1V/1 | |
| 0027H | Output Current 0.1A/1 | |
| 0028H | Main circuit DC Current 1V/1 | |
| 0029H | Analog Input VAIN Value; 10V/100.0% or 20mA/100.0% | |
| 002AH | Panel's VR input; 100%=(1-03) | |
| 002BH | Reserved | |
| 002CH Input Terminal status | 0 | Terminal 1 0: Open; 1: Close |
| | 1 | Terminal 2 0: Open; 1: Close |
| | 2 | Terminal 3 0: Open; 1: Close |
| | 3 | Terminal 4 0: Open; 1: Close |
| | 4 | Terminal 5 0: Open; 1: Close |
| | 5 | Terminal 6 0: Open; 1: Close |
| | 6 | Terminal 7 0: Open; 1: Close |
| | 7 | Terminal 8 0: Open; 1: Close |
| | 8~15 | Reserved |
| 002DH | Analog Output AO1 Value; 10V/100.0% | |
| 002EH | Reserved | |
| 002FH Output Terminal status | 0 | Terminals Ra-Rb-Rc ; 0: Open; 1: Close |
| | 1 | Terminals MO+-MO- ; 0: Open; 1: Close |
| | 2~15 | Reserved |

(3) Inverter Parameter Register (Read/Write): List of Inverter Parameter vs. Register Address

List of Inverter Parameter Register

| Address | Inverter Parameter | | Unit | Setting Range | Mark |
|---|---|---|---|---|---|
| 0100H | 0-01 | Display mode, Digital Controller | — | 0~1999 | |
| 0101H | 0-02 | Display content after Power ON | — | 0~2 | ★ |

| Address | Inverter Parameter | | Unit | Setting Range | Mark |
|---|---|---|---|---|---|
| 0180H | 1-01 | Inverter Capacity | — | 0~3 | |
| 0181H | 1-02 | Factory Setting Selection | — | 0~1 | |
| 0182H | 1-03 | Max. Output Frequency | 0.1Hz | 50.0~400.0Hz | |
| 0183H | 1-04 | Max. Voltage | 0.1V | 0.1~ 255.0V | |
| 0184H | 1-05 | Frequency of the Max. Voltage | 0.1Hz | 0.1~400.0Hz | |
| 0185H | 1-06 | Middle Output Frequency | 0.1Hz | 0.1~400.0Hz | |
| 0186H | 1-07 | Voltage at Middle Output Frequency | 0.1V | 0.1~255.0V | |
| 0187H | 1-08 | Min. Output Frequency | 0.1Hz | 0.1~400.0Hz | |
| 0188H | 1-09 | Voltage at Min. Output Frequency | 0.1V | 0.1~255.0V | |
| 0189H | 1-10 | Frequency Command Upper Bound | 1% | 0~109% | |
| 018AH | 1-11 | Frequency Command Lower Bound | 1% | 0~109% | |
| 018BH | 1-12 | Acceleration time 1 | 0.1s | 0.0~999.9s | ★ |
| 018CH | 1-13 | Deceleration time 1 | 0.1s | 0.0~999.9s | ★ |
| 018DH | 1-14 | Acceleration time 2 | 0.1s | 0.0~999.9s | ★ |
| 018EH | 1-15 | Deceleration time 2 | 0.1s | 0.0~999.9s | ★ |
| 018FH | 1-16 | Jog Frequency Command | 0.01Hz | 0.00~400.00 Hz | ★ |
| 0190H | 1-17 | S Curve Time in Starting Accel. | 0.1s | 0.0~1.0s | |
| 0191H | 1-18 | S Curve Time in Ending Accel. | 0.1s | 0.0~1.0s | |
| 0192H | 1-19 | S Curve Time in Starting Decel. | 0.1s | 0.0~1.0s | |
| 0193H | 1-20 | S Curve Time in Ending Decel. | 0.1s | 0.0~1.0s | |

| Address | Inverter Parameter | | Unit | Setting Range | Mark |
|---|---|---|---|---|---|
| 0200H | 2-01 | Run Source selection | — | 0~2 | |
| 0201H | 2-02 | Frequency Command selection | — | 0~3 | |
| 0202H | 2-03 | STOP method selection | — | 0~3 | |
| 0203H | 2-04 | Controller STOP button selection | — | 0~1 | |
| 0204H | 2-05 | Prohibition of REV run | — | 0~1 | |
| 0205H | 2-06 | Carrier Frequency Setting | — | 1~6 | |

| | | | | | |
|---|---|---|---|---|---|
| 0206H | 2-07 | External UP/DOWN Memory Function | — | 0~1 | |
| 0207H | 2-08 | Output frequency Up/Down function | — | 0~1 | |

| Address | Inverter Parameter | | Unit | Setting Range | Mark |
|---|---|---|---|---|---|
| 0280H | 3-01 | Analog Output FM Function Selection | — | 0~11 | |
| 0281H | 3-02 | Analog Output Gain | 1% | 1~255% | ★ |
| 0282H | 3-03 | Random Frequency Detection Level, accelerating | 0.1Hz | 0.0~400.0Hz | |
| 0283H | 3-04 | Random Frequency Detection Level, decelerating | 0.1Hz | 0.0~400.0Hz | |
| 0284H | 3-05 | Detection amplitude, for consistent Frequency | 0.1Hz | 0.1~25.5Hz | |
| 0285H | 3-06 | Ra -Rc function selection | — | 00~25 | |
| 0286H | 3-07 | MO function selection | — | 00~25 | |
| 0287H | 3-08 | Multiplier select, Pulse output | — | 01~16 | |

| Address | Inverter Parameter | | Unit | Setting Range | Mark |
|---|---|---|---|---|---|
| 0300H | 4-01 | Analog frequency command VIN gain | 0.1% | 0.0~1000.0% | ★ |
| 0301H | 4-02 | Analog frequency command VIN bias | 0.1% | -99.9~100.0% | ★ |
| 0302H | 4-03 | Analog Frequency Input command properties selection | — | 0~1 | |
| 0303H | 4-04 | Analog Frequency Command Input properties selection | — | 0~1 | |
| 0304H | 4-05 | Terminal MI2 Function Selection | — | 00~21 | |
| 0305H | 4-06 | Terminal MI3 Function Selection | — | 01~22 | |
| 0306H | 4-07 | Terminal MI4 Function Selection | — | 02~23 | |
| 0307H | 4-08 | Terminal MI5 Function Selection | — | 03~24 | |
| 0308H | 4-09 | Scan Times of Input Terminal | — | 0~1 | |
| 0309H | 4-10 | Analog Input Filter | — | 1~80 | |
| 030AH | 4-11 | Counter Setting Value | — | 0~9999 | |

| Address | Inverter Parameter | | Unit | Setting Range | Mark |
|---|---|---|---|---|---|
| 0380H | 5-01 | Frequency Command 1 | 0.01Hz | 0.00~400.00 Hz | ★ |
| 0381H | 5-02 | Frequency Command 2 | 0.01Hz | 0.00~400.00 Hz | ★ |
| 0382H | 5-03 | Frequency Command 3 | 0.01Hz | 0.00~400.00 Hz | ★ |
| 0383H | 5-04 | Frequency Command 4 | 0.01Hz | 0.00~400.00 Hz | ★ |
| 0384H | 5-05 | Frequency Command 5 | 0.01Hz | 0.00~400.00 Hz | ★ |
| 0385H | 5-06 | Frequency Command 6 | 0.01Hz | 0.00~400.00 Hz | ★ |

| | | | | | |
|---|---|---|---|---|---|
| 0386H | 5-07 | Frequency Command 7 | 0.01Hz | 0.00~400.00 Hz | ★ |
| 0387H | 5-08 | Frequency Command 8 | 0.01Hz | 0.00~400.00 Hz | ★ |
| 0388H | 5-09 | Auto Run mode operation selection | — | 0~6 | |
| 0389H | 5-10 | Auto Run mode operation selection 1 | — | 0~2 | |
| 038AH | 5-11 | Auto Run mode operation selection 2 | — | 0~2 | |
| 038BH | 5-12 | Auto Run mode operation selection 3 | — | 0~2 | |
| 038CH | 5-13 | Auto Run mode operation selection 4 | — | 0~2 | |
| 038DH | 5-14 | Auto Run mode operation selection 5 | — | 0~2 | |
| 038EH | 5-15 | Auto Run mode operation selection 6 | — | 0~2 | |
| 038FH | 5-16 | Auto Run mode operation selection 7 | — | 0~2 | |
| 0390H | 5-17 | Auto Run mode operation selection 8 | — | 0~2 | |
| 0391H | 5-18 | 1’st Step Time Under Auto Run Mode | 0.1s | 0.0~6000.0s | ★ |
| 0392H | 5-19 | 2’nd Step Time Under Auto Run Mode | 0.1s | 0.0~6000.0s | ★ |
| 0393H | 5-20 | 3’rd Step Time Under Auto Run Mode | 0.1s | 0.0~6000.0s | ★ |
| 0394H | 5-21 | 4’th Step Time Under Auto Run Mode | 0.1s | 0.0~6000.0s | ★ |
| 0395H | 5-22 | 5’th Step Time Under Auto Run Mode | 0.1s | 0.0~6000.0s | ★ |
| 0396H | 5-23 | 6’th Step Time Under Auto Run Mode | 0.1s | 0.0~6000.0s | ★ |
| 0397H | 5-24 | 7’th Step Time Under Auto Run Mode | 0.1s | 0.0~6000.0s | ★ |
| 0398H | 5-25 | 8’th Step Time Under Auto Run Mode | 0.1s | 0.0~6000.0s | ★ |

| Address | Inverter Parameter | | Unit | Setting Range | Mark |
|---|---|---|---|---|---|
| 0400H | 6-01 | Stall prevention during Accel. function selection | — | 0~1 | |
| 0401H | 6-02 | Stall prevention during Decel. function selection | — | 0~1 | |
| 0402H | 6-03 | Stall prevention during running function selection | — | 0~1 | |
| 0403H | 6-04 | Stall Prevention During Acceleration | 1% | 30~150% | |
| 0404H | 6-05 | Stall Prevention During Running | 1% | 30~150% | |
| 0405H | 6-06 | Detection Level, Over Torque | 1% | 30~150% | |
| 0406H | 6-07 | Detection Time, Over Torque | 0.1s | 0.0~25.5s | |
| 0407H | 6-08 | Over Torque Detection select | — | 0~4 | |
| 0408H | 6-09 | Motor overload protection select | — | 0~4 | |
| 0409H | 6-10 | Detection Level, Under Voltage | 1V | 150~210V | |

| Address | Inverter Parameter | | Unit | Setting Range | Mark |
|---|---|---|---|---|---|
| 0480H | 7-01 | Motor Rated Current | 0.1A | *****.*****A | |

| | | | | | |
|---|---|---|---|---|---|
| 0481H | 7-02 | No Load Current of Motor | 1% | 0~99% | |
| 0482H | 7-03 | Rated Slip of Motor | 0.1% | 0~9.9% | |
| 0483H | 7-04 | Auto torque compensation gain | 0.1 | 0.0~2.0 | ★ |

| Address | Inverter Parameter | | Unit | Setting Range | Mark |
|---|---|---|---|---|---|
| 0500H | 8-01 | DC Injection Braking Starting Frequency | 0.1Hz | 0.1~10.0Hz | |
| 0501H | 8-02 | DC Brake Current | 1% | 0~80% | |
| 0502H | 8-03 | DC Injection Braking Time at Stop | 0.1s | 0.0~25.5s | |
| 0503H | 8-04 | DC Injection Braking Time at Start | 0.1s | 0.0~25.5s | |
| 0504H | 8-05 | Re-Start selection after momentary interruption | — | 0~1 | |
| 0505H | 8-06 | Speed Search Current Level | 1% | 0~150% | |
| 0506H | 8-07 | Speed Search Deceleration Time | 0.1s | 0.1~25.5s | |
| 0507H | 8-08 | Min. Base Block Time | 0.1s | 0.5~5.0s | |
| 0508H | 8-09 | Frequency Jump Point 1 | 0.1Hz | 0.0~400.0Hz | |
| 0509H | 8-10 | Frequency Jump Point 2 | 0.1Hz | 0.0~400.0Hz | |
| 050AH | 8-11 | Frequency Jump Point 3 | 0.1Hz | 0.0~400.0Hz | |
| 050BH | 8-12 | Frequency Jump Range | 0.1Hz | 0.0~25.5Hz | |
| 050CH | 8-13 | Number of times, Reset after fault | — | 0~10 | |
| 050DH | 8-14 | Timer ON delay time | 0.1s | 0.0~999.9s | ★ |
| 050EH | 8-15 | Timer OFF delay time | 0.1s | 0.0~999.9s | ★ |
| 050FH | 8-16 | PID Function Selection | — | 0~1 | |
| 0510H | 8-17 | PID Detection gain | 1% | 1~1000% | ★ |
| 0511H | 8-18 | PID Proportional gain (P) | 1% | 1~1000% | ★ |
| 0512H | 8-19 | PID Integral Time (I) | 0.1s | 0.0~100.0s | ★ |
| 0513H | 8-20 | PID Differential time (D) | 1ms | 0~1000ms | ★ |
| 0514H | 8-21 | PID Output Bias | 1% | 0~109% | ★ |
| 0515H | 8-22 | PID Integral Upper Bound | 1% | 0~109% | |
| 0516H | 8-23 | PID Output Delay Time | 0.1s | 0.0~2.5s | |

| Address | Inverter Parameter | | Unit | Setting Range | Mark |
|---|---|---|---|---|---|
| 0580H | 9-01 | RS-485 Slave Address | — | 01~255 | |
| 0581H | 9-02 | RS-485 baud rate setting | — | 0~3 | |
| 0582H | 9-03 | RS-485 transmission parity setting | — | 0~3 | |
| 0583H | 9-04 | RS-485 comm. Fault stop selection | — | 0~3 | |
| 0584H | 9-05 | Communication Fault Detection Time | 0.1s | 0.0~25.5s | |

| | | |
|---|---|---|
| 0600H | Save parameters into EEPROM | Write 0000H here will save the parameters into EEPROM |

※ Reading of all parameters are not confined with any limitations of modes, but writing is only applicable in the PRGM mode unless specified ★ applicable both in PRGM and DRIVE.

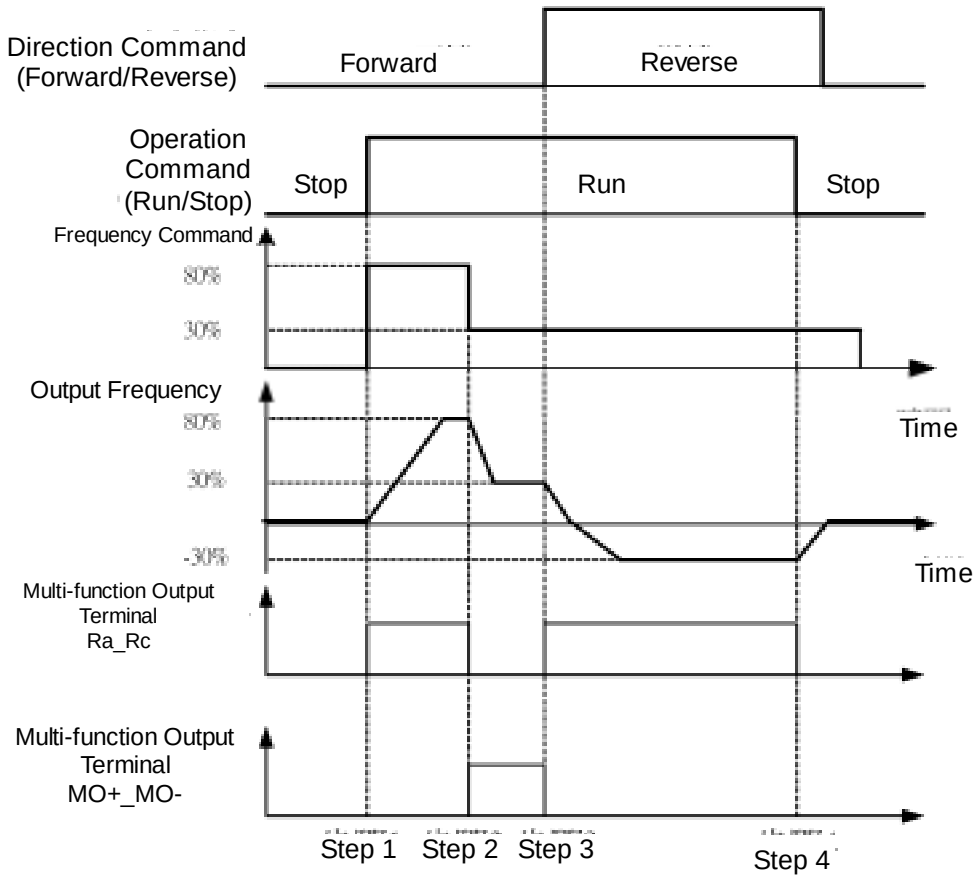
## 8. Content of Error Codes

Content of error message display is as per the following Table:

| Error Code | Error Name | Possible Cause |
|---|---|---|
| 01H | Function Code Error | Function code is not 03H, 08H or 10H; or Function code is 08H but sub- Function code is not 0000H |
| 02H | Data Address Error | Invalid register address during Retrieval / Writing of command |
| 03H | Data Value Error | Invalid data during Read / Write of command |
| 04H | CRC_16 Error | CRC reception differs from calculated CRC |
| 21H | Device Busy | Handling task of the previous command, such as parameter change or storing data into EEPROM |
| 22H | Device Fail | EEPROM fail while writing data |
| No response | Data Format Error | Invalid format of received data |
| No response | UART Error | Parity bit, Overrun or Frame error detected during transfer. |

## 9. Example of TDS-F8 Communication

Demonstrates how a TDS-F8 Inverter, with communication address 1, is controlled by PLC via the RS-485 port for the following operations:




Correctly setup inverter parameters 9-02 (transfer speed), 9-03 (Parity setting), 9-04 (Inverter stop method during RS-485 communication failure) and 9-05 (Detection time for releasing alarm after a communication failure) according to the previous descriptions, then setup the following parameters:

(i) 9-01 = 01 (Inverter Address)

(ii) 2-01 =2 (Operation Command controlled by RS-485 communication)

(iii) 2-02 =2 (Main Speed Command controlled by RS-485 communication)

(iv) 3-06 =25 (Terminal Ra controlled by RS-485 communication)

(v) 3-07 =25 (Terminal MO controlled by RS-485 communication)

Then connect cables according to wiring procedures and carry out communication. Configure the Master (PLC) Controller with the following program for accomplishing the desired operations:

**Step 1:**

Command message sent by Master

| Slave Address | | 01H |
|---|---|---|
| Function Code | | 10H |
| Head Address | High Byte | 00H |
| | Low Byte | 00H |
| Access Count | High Byte | 00H |
| | Low Byte | 08H |
| Data Byte Count | | 10H |
| 1st Data byte | High Byte | 00H |
| | Low Byte | 01H |
| 2nd Data byte | High Byte | 5DH |
| | Low Byte | C0H |
| 3rd Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 4th Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 5th Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 6th Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 7th Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 8th Data byte | High Byte | 00H |
| | Low Byte | 01H |
| CRC-16 | High Byte | 44H |
| | Low Byte | 91H |

Response message from Slave (Inverter)

| Slave Address | | 01H |
|---|---|---|
| Function Code | | 10H |
| Head Address | High Byte | 00H |
| | Low Byte | 00H |
| Access Count | High Byte | 00H |
| | Low Byte | 08H |
| CRC-16 | High Byte | C1H |
| | Low Byte | CFH |

Note:

1. Send 1st Data byte 0001H to register 0000H, stand for Forward Run.
2. Send 2nd Data byte 5DC0H to register 0001H, for running in 80% speed; (1-03) (Max. Frequency output) is100%(7530H).
3. Send 8th Data byte 0001H to register 0007H, stand for control of multi-function by RS-485 and for enable output terminals Ra-Rc and disable MO+_MO-.
4. Then the Inverter is initiated; multi-function output terminals Ra-Rc activated, and acceleration is carried out to 80% of max. Output Frequency according to Acceleration Time.

**Step 2:**

Command message sent by Master

| Slave Address | | 01H |
|---|---|---|
| Function Code | | 10H |
| Head Address | High Byte | 00H |
| | Low Byte | 00H |
| Access Count | High Byte | 00H |
| | Low Byte | 08H |
| Data Byte Count | | 10H |
| 1st Data byte | High Byte | 00H |
| | Low Byte | 01H |
| 2nd Data byte | High Byte | 3AH |
| | Low Byte | 98H |
| 3rd Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 4th Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 5th Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 6th Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 7th Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 8th Data byte | High Byte | 00H |
| | Low Byte | 01H |
| CRC-16 | High Byte | FDH |
| | Low Byte | 2EH |

Inverter return from Slave (Inverter)

| Slave Address | | 01H |
|---|---|---|
| Function Code | | 10H |
| Head Address | High Byte | 00H |
| | Low Byte | 00H |
| Access Count | High Byte | 00H |
| | Low Byte | 08H |
| CRC-16 | High Byte | C1H |
| | Low Byte | CFH |

Note:

1. Send 1st Data byte 0001H to register 0000H, stand for Forward Run.
2. Send 2nd Data byte 3A98H to register 0001H, for running in 50% speed.
3. Send 8th Data byte 0001H to register 0007H, stand for control of multi-function by RS-485 and for enable output terminals Ra-Rc.
4. Then the Inverter multi-function output terminals MO+-MO- are disabled and Ra-Rc activated, and deceleration is carried out to 50% of max. Output Frequency according to Deceleration Time.

**Step 3**

Command message sent by Master

| Slave Address | | 01H |
|---|---|---|
| Function Code | | 10H |
| Head Address | High Byte | 00H |
| | Low Byte | 00H |
| Data Byte Count | | 10H |
| 1st Data byte | High Byte | 00H |
| | Low Byte | 03H |
| 2nd Data byte | High Byte | 3AH |
| | Low Byte | 98H |
| 3rd Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 4th Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 5th Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 6th Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 7th Data byte | High Byte | 00H |
| | Low Byte | 00H |
| 8th Data byte | High Byte | 00H |
| | Low Byte | 01H |
| CRC-16 | High Byte | 7FH |
| | Low Byte | 2FH |

Inverter return from Slave (Inverter)

| Slave Address | | 01H |
|---|---|---|
| Function Code | | 10H |
| Head Address | High Byte | 00H |
| | Low Byte | 00H |
| Access Count | High Byte | 00H |
| | Low Byte | 08H |
| CRC-16 | High Byte | C1H |
| | Low Byte | CFH |

Note:

1. Send 1st Data byte 0003H to register 0000H, stand for Reverse Run.
2. Send 2nd Data byte 3A98H to register 0001H, for running in 50% speed.
3. Send 3rd Data byte 0001H to register 0007H, stand for control of multi-function by RS-485 and for enable output terminals Ra-Rc.
4. Then the Inverter shall decelerate to Stop from 50% speed and reverse and accelerate to 50% of the full Reverse speed; multi-function output terminals Ra-Rc continue Output actions.

**Step 4:**

Command message sent by Master

| | | |
|---|---|---|
| Slave Address | | 01H |
| Function Code | | 10H |
| Head Address | High Byte | 00H |
| | Low Byte | 00H |
| Access Count | High Byte | 00H |
| | Low Byte | 01H |
| Data Byte Count | | 02H |
| 1st Data byte | High Byte | 00H |
| | Low Byte | 00H |
| CRC-16 | High Byte | A6H |
| | Low Byte | 50H |

Inverter return from Slave (Inverter)

| | | |
|---|---|---|
| Slave Address | | 01H |
| Function Code | | 10H |
| Head Address | High Byte | 00H |
| | Low Byte | 00H |
| Access Count | High Byte | 00H |
| | Low Byte | 01H |
| CRC-16 | High Byte | C1H |
| | Low Byte | C9H |

**Note:**

1. Send 1st Data byte 0000H to register 0000H, stand for stopping the operation.
2. Then the Inverter decelerates from 50% Reverse to ZERO speed and stop operation. Since the content of 0007H register has not been changed, the multi-function output terminals Ra-Rc continue their Output actions.