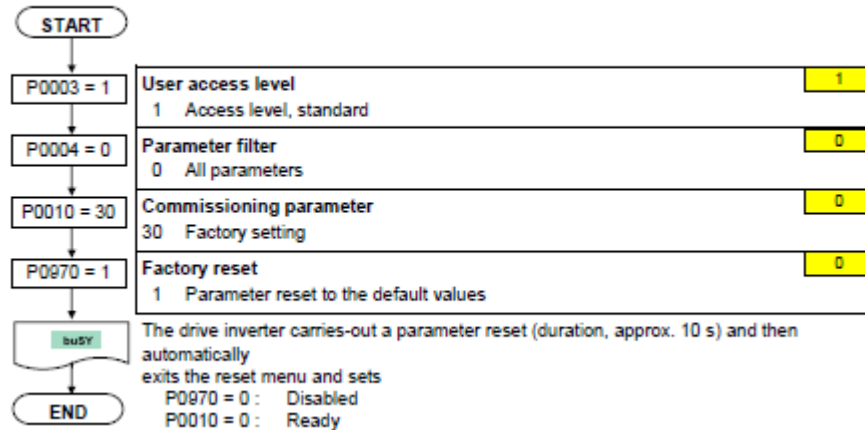


Mengontrol inverter Micromaster dengan USS Protocol

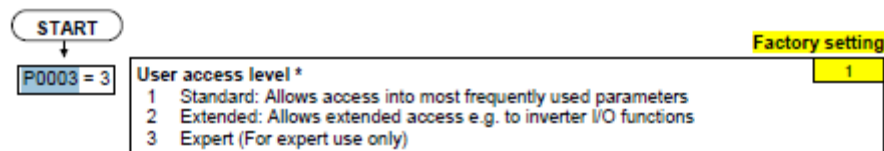
Untuk mengontrol inverter melalui protokol USS, berikut adalah langkah – langkahnya :

1. Pertama kali kita bisa mereset inverter ke Factory Setting.

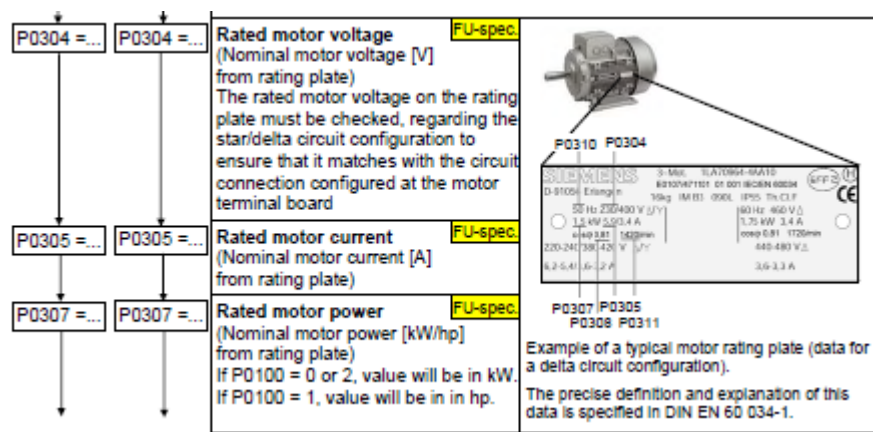
Reset to the factory setting

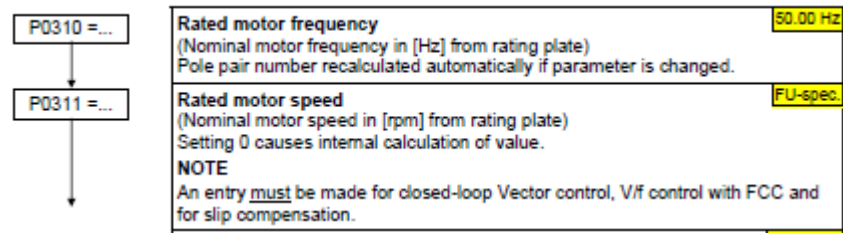


2. Ubah user acces level ke Experte Mode dengan mengubah Parameter P0003 ke 3.

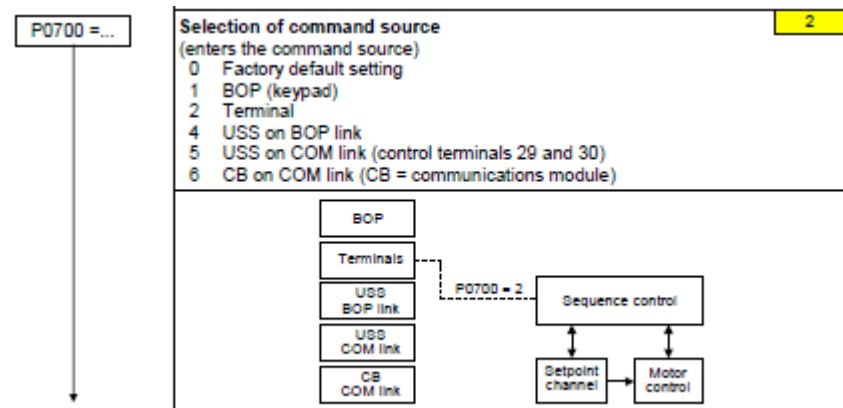


3. Atur data parameter motor, masuk ke P0010 (Commisining parameter) dan ubah nilainya ke 1 agar menu untuk setting motor muncul. Kemudian masuk ke Parameter P0304,P0305,P0307,P0310,P0311.

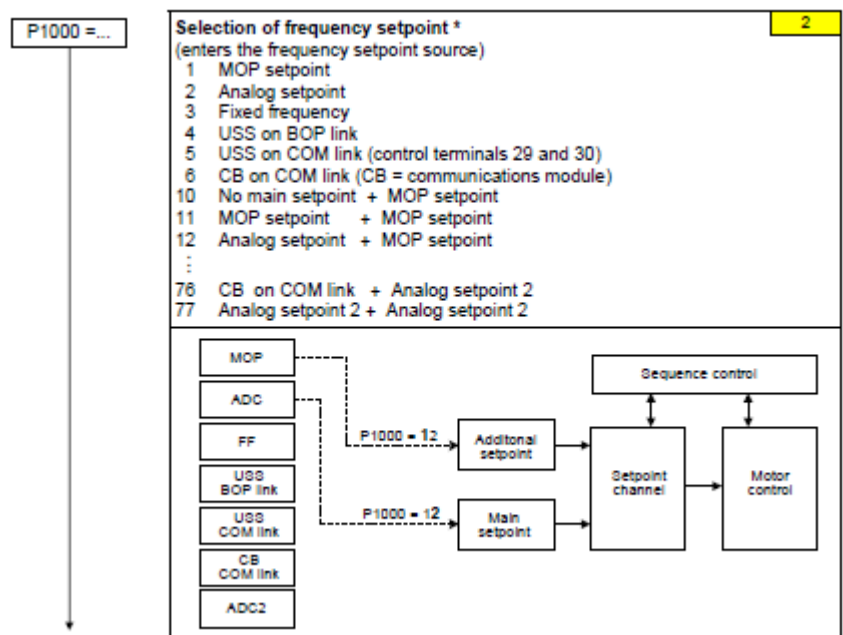




4. Masuk ke parameter P0700 untuk mengatur control mode local/remote.
Pilih ke USS on COM link (terminal 29 dan 30)



5. Atur Selection frequency setpoint ke USS COM link , masuk ke parameter P1000 dan atur ke P1000 = 5 (USS on COM link terminal 29 dan 30).



6. Atur Ramp up / Acceleration dan Ramp down / Deceleration dari inverter , masuk ke P1120

| | | |
|------------|--|---------|
| P1120 =... | Ramp-up time (enters the ramp-up time in s) Time taken for motor to accelerate from standstill up to maximum motor frequency (P1082) when no rounding is used. If a ramp-up time is parameterized which is too low, then this can result in alarm A0501 (current limit value) or the drive inverter being shutdown with fault F0001 (overcurrent). | 10.00 s |
| P1121 =... | Ramp-down time (enters the deceleration time in s) Time taken for motor to decelerate from maximum motor frequency (P1082) down to standstill when no rounding is used. If the ramp-down time is parameterized too low, then this can result in alarms A0501 (current limit value), A0502 (overvoltage limit value) or the drive inverter being powered-down with fault F0001 (overcurrent) or F0002 (overvoltage). | 10.00 s |

7. Atur Serial link referency frequency, masuk ke P2000.

| | | |
|-------------|---|----------|
| p2000 = ... | Reference frequency (entered in Hz) The reference frequency in Hertz corresponds to a value of 100 %. This setting should be changed if a maximum frequency of higher than 50 Hz is required. It is automatically changed to 60 Hz if the standard 60 Hz frequency was selected using p0100. NOTE This reference frequency effects the setpoint frequency as both the frequency setpoints via USS as well as via PROFIBUS (FB100) (4000H hex \triangleq 100 % \triangleq p2000) refer to this value. | 50.00 Hz |
|-------------|---|----------|

8. Atur USS Normalization P2009 Index 0 = 0

9. Setting BaudRate, address, PKW dan PZD dari inverter, masuk ke P2010,P2011,P2012,P2013

3.5.7.1 Serial Interface (USS)

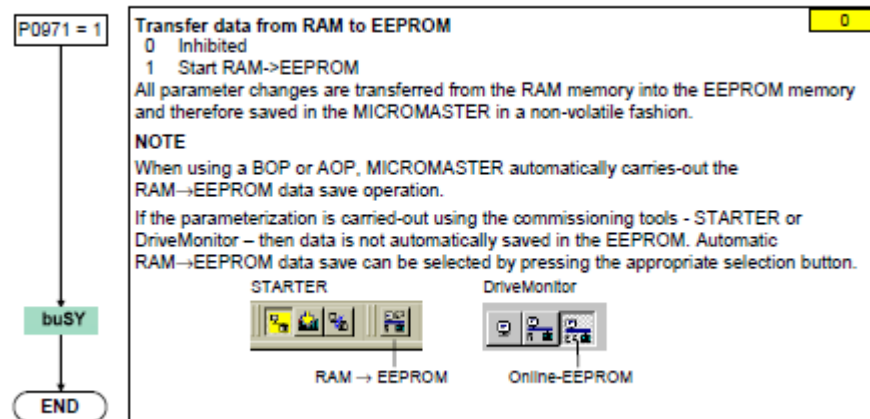
| | | | |
|------------|--|-----|--|
| P2010 =... | USS baud rate Sets baud rate for USS communication. | 6 | Possible Settings: 4 2400 Baud 5 4800 Baud 6 9600 Baud 7 19200 Baud 8 38400 Baud 9 57600 Baud 10 76800 Baud 11 93750 Baud 12 115200 Baud |
| P2011 =... | USS address Sets unique address for inverter. | 0 | |
| P2012 =... | USS PZD length Defines the number of 16-bit words in PZD part of USS telegram. | 2 | |
| P2013 =... | USS PKW length Defines the number of 16-bit words in PKW part of USS telegram. | 127 | |

10. Atur serial link timeout dari inverter,masuk ke P2014

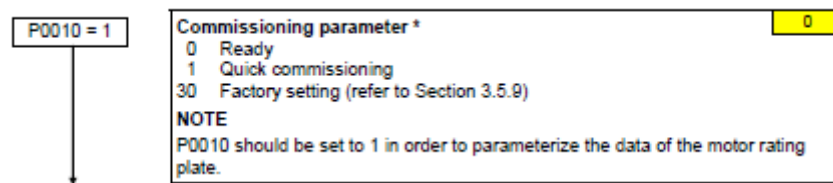
This is the maximum permissible period between two incoming data telegrams. This feature is used to turn off the inverter in the event of a communications failure. Timing starts after a valid data telegram has been received. If a further data telegram is not received within the specified time period, the inverter will trip and display fault code F0070. Setting the value to zero switches off the control. Use Table 11-1 to calculate the time between the status polls to the drive.

11. Transfer data dari RAM ke EEPROM agar data tidak hilang saat power off.
Masuk ke P971 dan ubah nilainya menjadi 1.

3.5.7.21 End of commissioning



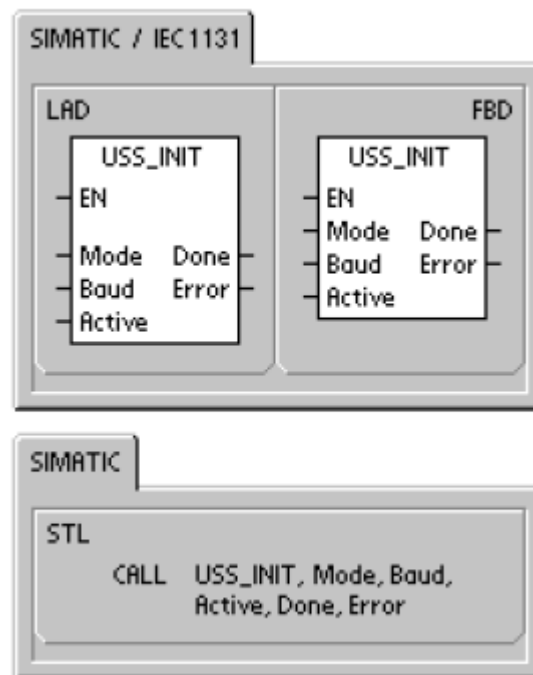
12. Setelah semua parameter sudah disetting selanjutnya ubah parameter P0010 ke 0 (ready).



Daftar instruksi USS Protocol pada PLC S7200 MicroWIN.

USS_INIT

Digunakan untuk menginisialisasi komunikasi antara Inverter dengan PLC untuk pertama kali.

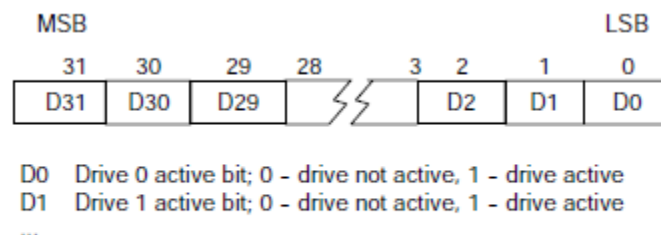


EN = Enable untuk menjalankan instruksi biasanya menggunakan first scan bit atau positif , negatif edge.

MODE = Untuk mengatur mode komunikasinya, jika 1 maka USS Protocol active, jika 0 maka PP1 active dan USS Protocol tidak aktif.

BAUD = Baudrate , untuk mengatur kecepatan transfer data/ baudrate.

ACTIVE = Sebagai indikasi Inverter mana yang aktif(0 - 31) nilai ini dapat diisi langsung dengan mengaktifkan masing- masing bitnya.

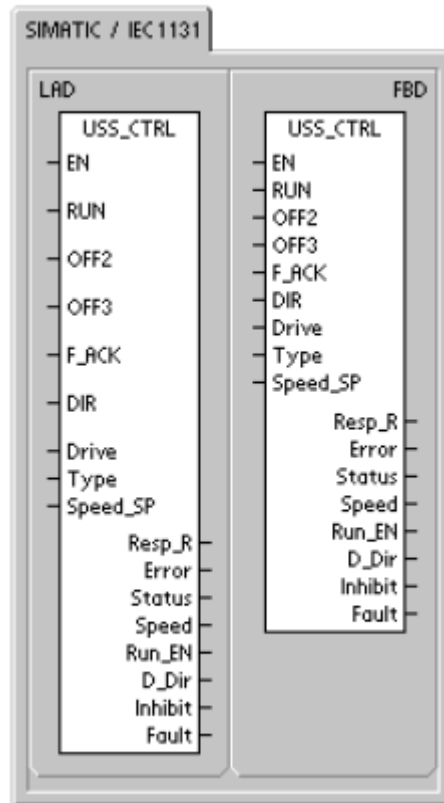


DONE = Untuk indikator bahwa instruksi telah selesai dieksekusi.

ERROR = Berisi kode error , jika instruksi gagal dieksekusi.

USS_CTRL

Digunakan untuk mengontrol drive yang sedang aktif. masing masing drive hanya dapat menambahkan instruksi ini satu (1).



EN = Enable, untuk mengaktifkan instruksi, bit ini harus ON terus menerus. Dapat menggunakan bit Always_On (SM 0.0).

RUN = Running, untuk memberi komando inverter untuk Start Running.

OFF2 = Coasting Stop , digunakan untuk menghentikan inverter secara perlahan.

OFF3 = Quick Stop , digunakan untuk menghentikan inverter secara cepat.

F_ACK = Fault Acknowledge, digunakan untuk mengACK/ mereset fault yang ada.

DIR = Direction untuk memilih putaran pada inverter.

TYPE = untuk memilih tipe dari drive 0 = Micromaster 3 , 1 = Micromaster 4.

SPEED_SP = Setpoint Speed untuk mengatur kecepatan dari Drive

RESP_R = Respon receive, bit on 1 scan dan semua nilai akan terupdate.

ERROR = Berisi kode error jika instruksi gagal dieksekusi.

STATUS = Berisi Status Word yang dikirimkan inverter ke PLC, menandakan kondisi inverter.

SPEED = Kecepatan actual sekarang.

RUN_EN = Indikator drive , Running = 1 , 0 = Stopped.

D_DIR = indikator putaran motor.

INHIBIT = indikator inhibit bit pada drive/inverter.

FAULT = indikator fault bit , 0 = No Fault , 1 = Fault.

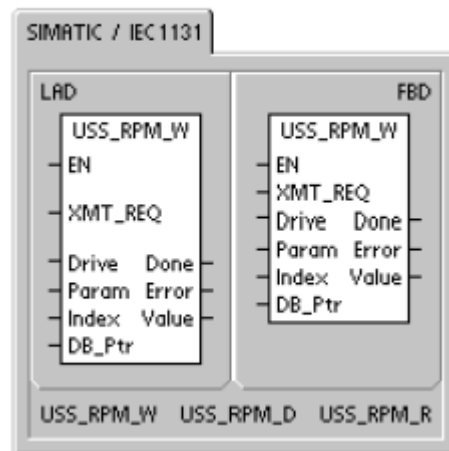
USS_RPM_X

Digunakan untuk membaca parameter pada drive. USS_RPM terdapat 3 jenis yaitu :

USS_RPM_W = untuk word parameter.

USS_RPM_D = untuk double word parameter.

USS_RPM_R = untuk floating point parameter.



EN = Enable , untuk menjalankan request ke inverter.

XMT_REQ = pulse untuk transmisi data ke inverter.

DRIVE = address micromaster yang akan dibaca datanya.

PARAM = number parameter yang akan direquest.

INDEX = Index value dari parameter.

DB_PTR = untuk menyimpan hasil eksekusi/ error atau isu.

DONE = untuk indikator bahwa request berhasil dieksekusi.

ERROR = kode pada saat request gagal dieksekusi.

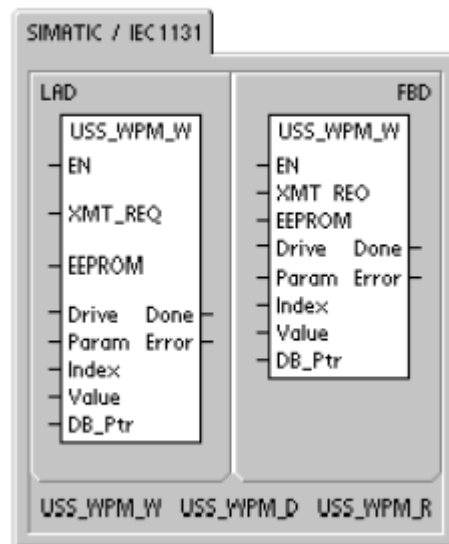
VALUE = nilai hasil pembacaan instruksi.

USS_WPM_X

Digunakan untuk mengubah nilai/write parameter pada drive. USS_WPM terdapat 3 jenis yaitu :
USS_WPM_W = untuk word parameter.

USS_WPM_D = untuk double word parameter.

USS_WPM_R = untuk floating point parameter.



EN = Enable , untuk menjalankan request ke inverter.

XMT_REQ = pulse untuk transmisi data ke inverter.

DRIVE = address micromaster yang akan dibaca datanya.

PARAM = number parameter yang akan direquest/ di write.

INDEX = Index value dari parameter.

DB_PTR = untuk menyimpan hasil eksekusi/ error atau isu.

DONE = untuk indikator bahwa request berhasil dieksekusi.

ERROR = kode pada saat request gagal dieksekusi.

VALUE = berisi nilai yang akan di write ke parameter

Status Word

Merupakan Word yang memberikan informasi tentang keadaan inverter/drive saat ini ke PLC. Terdiri dari 16 bit (0 – 15) yang masing – masing mempunyai arti tersendiri.

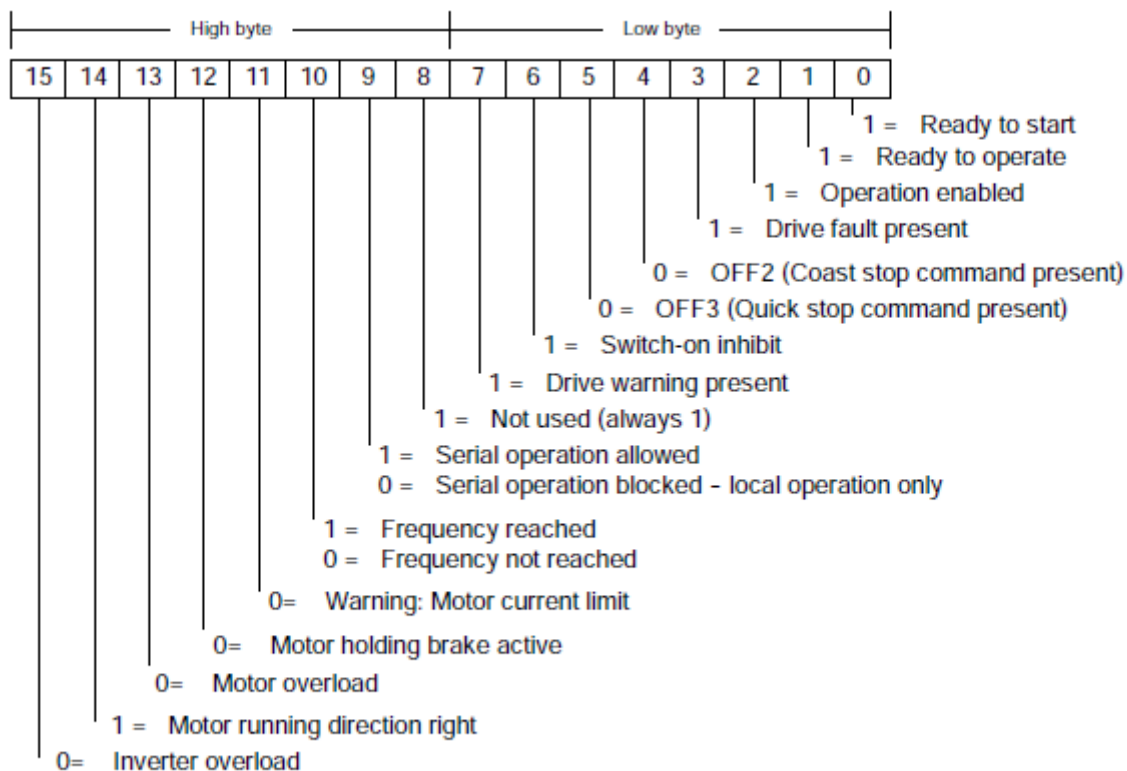


Figure 11-4 Status Bits for Standard Status Word for MicroMaster 4 and Main Feedback

Control Word

Merupakan Word yang digunakan untuk mengontrol inverter lewat komunikasi, terdiri dari 16 bit yang masing- masing bitnya memiliki arti tersendiri.

| Bit | Value | Significance | Comments |
|-----|-------|---------------------|---|
| 0 | 1 | ON | Ready; voltage available at the converter, i. e. main contactor in (if available); the field is established; if progression is not realized within a delay time, which can be parameterized (t_{delay}), then the "switch-on inhibit" status is entered. $t_{delay} = 0 \dots 20 \text{ min}$, 20 min is interpreted as being infinite. Converter-specific: Version 1: Field is established (standstill field); pulses are inhibited. Version 2: DC link is charged; inverter pulses are inhibited. Version 3: Rectifier and inverter pulses are inhibited, commutating capacitors are not charged, nor post-charged. Version 4: Field-, rectifier- and inverter pulses are inhibited. |
| | 0 | OFF 1 | Shutdown (depending on the status of control word bits 0, 1 and 2 return to the status "switch-on inhibit", "not ready to switch-on" or "ready to switch-on"); deceleration along the ramp-function generator ramp, or at the DC link voltage limit; at $n/f = 0$ and $i = 0$, supply is disconnected: Main contactor out (if available). |
| 1 | 1 | Operating condition | All "OFF 2" commands are canceled. |
| | 0 | OFF 2 | Voltage disconnected: Converter-specific: Version 1: Shift pulses to the firing angle limit α_{max} ; inhibit pulses at $i = 0$. Version 2: Inhibit pulses. Version 3: Shift pulses to the firing angle limit α_{max} ; inhibit the rectifier and inverter pulses at $i = 0$. Version 4: As version 3, additionally excitation and excitation contactor out. The main contactor is then switched-out (if available) and the drive goes into the switch-on inhibit condition; the motor coasts down. |
| 2 | 1 | Operating condition | All "OFF 3" commands are canceled. |
| | 0 | OFF 3 | Fast stop, if necessary cancel operating inhibit, fast as possible deceleration, e. g. along the current limit or at the DC link limit at $n/f = 0$; inhibit rectifier pulses, then the power is disconnected (contactor out) and the drive goes into the switch-on inhibit condition. |

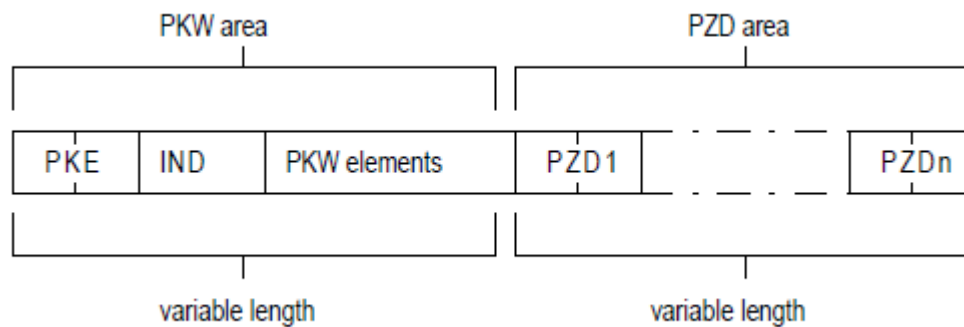
Table 5.2: Assignment of control word bits 0 to 2

| Bit | Value | Significance | Comments |
|-----|-------|---------------------------------|---|
| 3 | 1 | Enable operation | Enable electronics + pulses Converter-specific: Version 1: Enable excitation. Version 2: If configured, de-energization time delay then the inverter pulses are enabled and the excitation current impressed. Version 3: If configured, de-energization time delay, then the rectifier and inverter pulses are enabled. Commutating capacitors pre-charge. Version 4: Pulses enabled for rotor positioning, then the rectifier and converter pulses are enabled. The drive then accelerates to the setpoint. |
| | 0 | Inhibit operation | Converter-specific: Version 1: Shift pulses to the firing angle limit α_{max} ; inhibit pulses at $i = 0$, and set excitation to the standstill excitation level. Version 2: Inhibit inverter pulses. Version 3: Shift rectifier pulses to the firing angle limit α_{max} ; inhibit rectifier and inverter pulses at $i = 0$. Version 4: Shift the rectifier pulses to the firing angle limit α_{max} ; inhibit rectifier, inverter and excitation pulses at $i = 0$. The drive coasts down (ramp-function generator to 0, or tracking) and the drive goes into the "ready" status (refer to the control word, bit 0). |
| 4 | 1 | Operating condition | |
| | 0 | Inhibit ramp-function generator | Ramp-function generator output is set to 0. The main contactor remains in, the converter is not isolated from the supply, drive decelerates along the current limit or at the DC link limit. |
| 5 | 1 | Enable ramp-function generator | |
| | 0 | Hold ramp-function generator | The setpoint from the ramp-function generator is held. |
| 6 | 1 | Enable setpoint | Selected value at the input of the ramp-function generator is switched-in. |
| | 0 | Inhibit setpoint | Selected value at the input of the ramp-function generator is set to 0. |
| 7 | 1 | Acknowledge | Group signal is acknowledged at the rising edge; converter is in the "fault" condition until the fault is removed, and then goes into the "switch-on inhibit" condition. |
| | 0 | No significance | |

| Bit | Value | Significance | Comments |
|-----------------|-------|----------------------|--|
| 8 ¹⁾ | 1 | Inching 1 ON | Prerequisite: Operation is enabled and $n(\text{set}) = 0$. Drive accelerates as fast as possible to inching setpoint 1. |
| | 0 | Inching 1 OFF | Drive brakes as fast as possible, if "Inching 1" was previously ON, and goes into the condition "operation enabled" at $n/f = 0$ and $i = 0$. |
| 9 ¹⁾ | 1 | Inching 2 ON | Prerequisite: Operation is enabled and $n(\text{set}) = 0$. Drive accelerates as fast as possible to inching setpoint 2. |
| | 0 | Inching 2 OFF | Drive brakes as fast as possible, if "Inching 2" was previously ON, and goes into "operation enabled" at $n/f = 0$ and $i = 0$. |
| 10 | 1 | Control from the PLC | Control via interface, process data valid |
| | 0 | No control | Process data invalid, i. e. the "old" process data are retained |
| 11-15 | | Converter-specific | Significance not specified |

Table 5-4: Assignment of control word bits 8 to 15

Format Data Komunikasi dengan USS Protocol

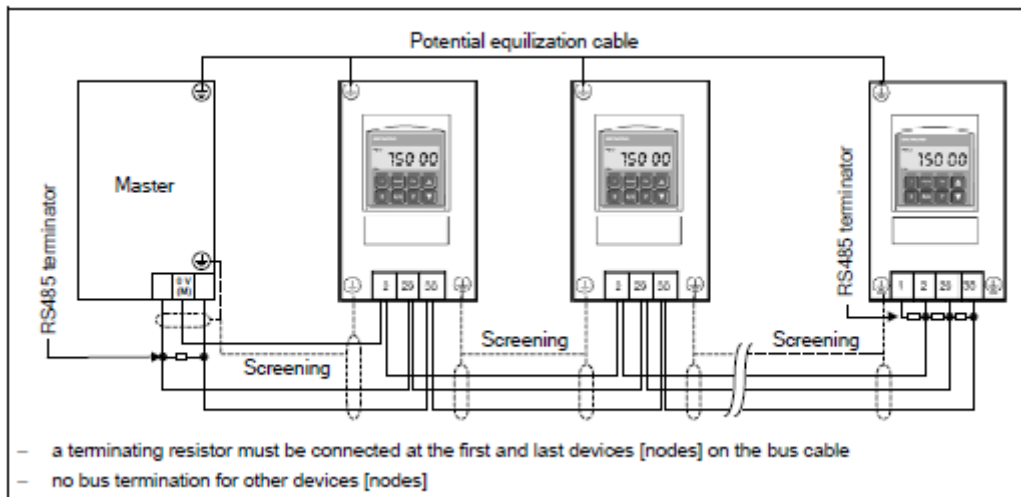


Pada USS Protocol Format datanya hampir mirip seperti PROFIBUS yaitu terdiri dari 2 block data PKW (Parameter ID Value) dan PZD (Parameter process data).

PKW berisi Parameter ID, Index yang akan dibaca atau ditulis ke drive/inverter, sedangkan PZD area berisi Control Word (PLC to Drive), Status Word (Drive to PLC), Main Reference value (PLC to Drive) dan Main Actual Value (Drive to PLC).

Untuk menghubungkan PLC dengan Inverter dapat menggunakan RS485 dengan maximum 31 node. Baudrate dari masing-masing inverter harus sama dengan baudrate dari PLC. Berikut ini baudrate yang disarankan untuk dipakai.

| Baud rate in bit/s | Start interval in ms |
|-----------------------|-------------------------|
| 9600 | 2.30 ms |
| 19200 | 1.15 ms |
| 38400 | 0.58 ms |
| 187500 | 0.12 ms |



Pada saat menghubungkan PLC dengan inverter(slave), maka perlu dipasang resistor pada awal dan ahir device.

Pada inverter Micromaster terdapat 2 kategori parameter yaitu parameter yang hanya dapat dibaca saja dan parameter yang dapat di baca sekaligus ditulis(write → diubah nilainya dari PLC).

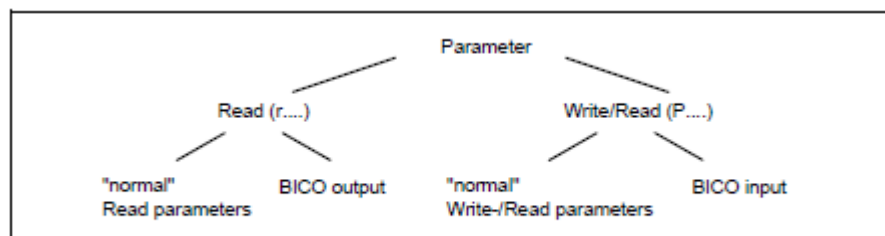


Fig. 3-1 Parameter types

Kedua kategori tersebut di bedakan dengan symbol (r...) dan (P...).Contoh parameter yang hanya dapat dibaca saja yaitu seperti, Voltage output, Arus actual,speed actual,thermal.Sedangkan contoh parameter yang dapat di baca dan tulis seperti refference speed, baudrate,frequency setpoint, ON/OFF.

Pada saat process Read atau Write dari PLC ke inverter bisa mengalami kegagalan/error, di instruksi PLC terdapat error code yang mempunyai arti sebagai berikut.

| Error Codes | Description |
|-------------|---|
| 0 | No error |
| 1 | Drive did not respond |
| 2 | A checksum error in the response from the drive was detected |
| 3 | A parity error in the response from the drive was detected |
| 4 | An error was caused by interference from the user program |
| 5 | An illegal command was attempted |
| 6 | An illegal drive address was supplied |
| 7 | The communications port was not set up for USS protocol |
| 8 | The communications port is busy processing an instruction |
| 9 | The drive speed input is out of range |
| 10 | The length of the drive response is incorrect |
| 11 | The first character of the drive response is incorrect |
| 12 | The length character in the drive response is not supported by USS instructions |
| 13 | The wrong drive responded |
| 14 | The DB_Ptr address supplied is incorrect |
| 15 | The parameter number supplied is incorrect |
| 16 | An invalid protocol was selected |
| 17 | USS is active; change is not allowed |
| 18 | An illegal baud rate was specified |
| 19 | No communications: the drive is not ACTIVE |
| 20 | The parameter or value in the drive response is incorrect or contains an error code |
| 21 | A double word value was returned instead of the word value requested |
| 22 | A word value was returned instead of the double word value requested |

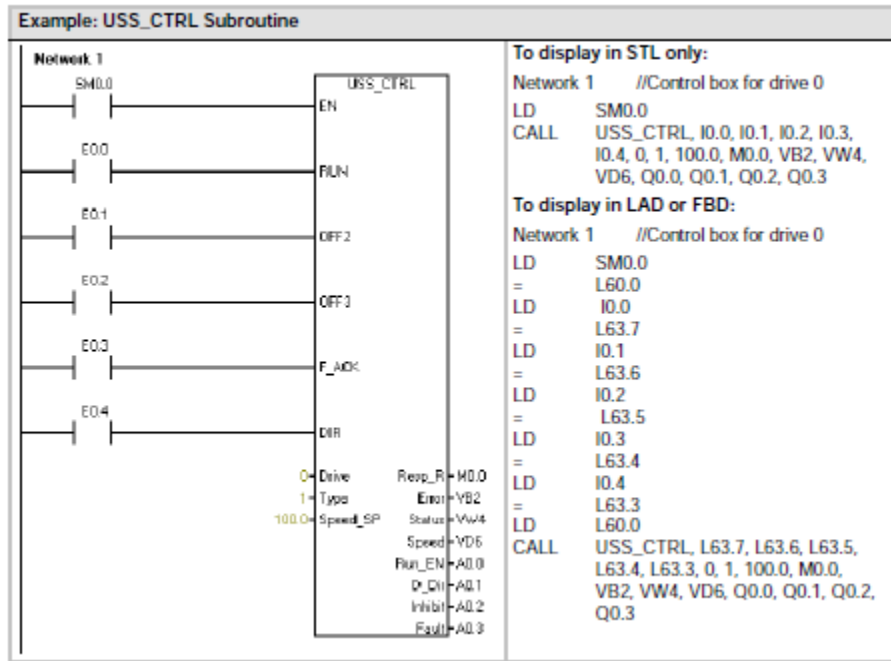
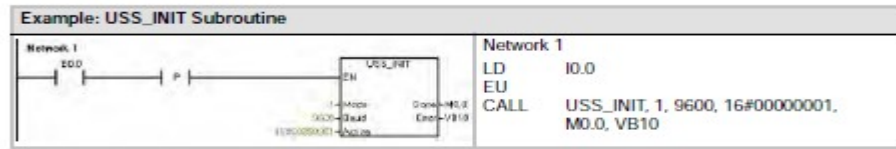
USS Protocol hanya dapat ditambahkan ke program apabila librarynya ditambahkan ke software MicroWin.

You find these instructions in the Libraries folder of the STEP 7-Micro/WIN instruction tree. When you select a USS instruction, one or more associated subroutines (USS1 through USS7) are added automatically.

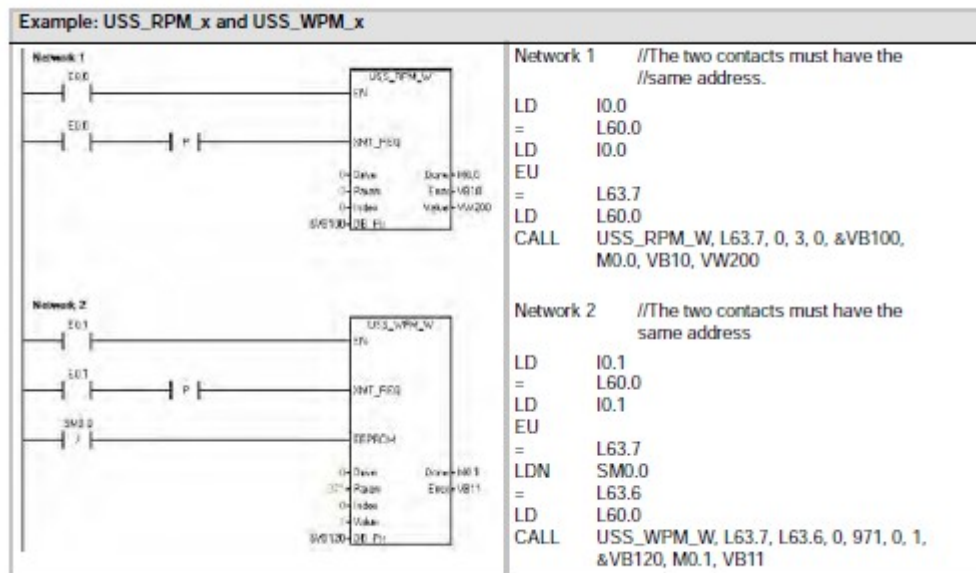
Siemens Libraries are sold on a separate CD, STEP 7-Micro/WIN Add-On: Instruction Library, with the order number 6ES7 830-2BC00-0YX0. After version 1.1 of the Siemens Library is purchased and installed, any subsequent STEP 7-Micro/WIN V3.2x and V4.0 upgrade that you install will also upgrade your libraries automatically at no additional cost (when library additions or modifications are made).

Sample Program for the USS Protocol in S7200 – MicroWIN

**Example initial uss protocol in MicroWin*



**Example Control instruction from PLC in MicroWin*



**Example Read dan Write parameter from PLC in MicroWin*