PLETTENBERG

High End Elektromotoren-Manufaktur

Operating manual motor controller

MST 60-80

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1. Introduction

Legal provisions

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Scope of valitidy

This document applies for the following device types:

Controller type
MST 60-80

This manual describes the features, installation and operation of Plettenberg motor control MST60-80.

Please read the instruction manual carefully and completely before using the controller. Disregarding the hints and instructions can be fatal and can cause lethal injuries! The limitation of the length of the battery input cables is mandatory(see chapter 4).

If you have questions please do not hesitate to contact us.

The engine control MST60-80has been specially developed for the use with brushless Plettenberg electric motors with sensors. Brushless motors from other manufacturers can only be connected, if they are equipped with 3 Hall sensors in 120 ° electrical arrangement. We assume no guarantee for the proper functioning of the MST60-80 with motors from other manufacturers.

The MST60-80 can drive brushless motors electrically up to 240000 rpm. A 20-pole motor, for example, makes 10 electrical revolutions doing one shaft rotation. The maximum speed for such a 20-pole motor is calculated: 240000rpm / 10pole pairs = 24000rpm.
The powerful 32-bit microprocessor allows a sensitive and fast motor control in conjunction with a very universal use. The measured values are displayed in real time on the RS232 interface in plain text so that they can be evaluated with a PC or other microprocessor control easy.

The firmware of the MST60-80 can be updated. However, it has to be sent to the factory for update.

The MST60-80 is delivered as standard with analog interface.
If required, the MST60-80 can be delivered with impulse interface or CAN 2.0 bus interface instead of the analog interface.

2. Technical data

Weight: approx. 230g without connectors

Length: 112 mm with flange, 95 mm without flange

Width: 56 mm

Height: 19 mm without connectors

Protection class: IP40

Maximum Speed: 240000rpm electrical

Maximum continuous power 4800 W

Maximum short term power 7200 W

Battery voltage range 12 V to 52 V nominal

Permissible supply voltage 10 V to 60 V

Maximum current 120A / 80A continuous current (at 25 ° C ambient temperature)
At 50 ° C ambient temperature, the continuous current is 65 A.
At 75 ° C ambient temperature, the continuous current is 46 A.

The continuous current data refer to standard atmosphere (1013mBar 25 ° C), a heat sink with 5 ° C / W and 100% PWM. The continuous current is dependet by the engine and engine timing, i. depending on the used motor, the continuous current may also be lower.

5V power supply (Max 50mA) for Hall sensors and electronic throttle and electronic brake pedal.

Two 0-5V analog inputs for throttle and brake function. One digital input for activating the reverse function.

An additional analog input for motor temperature monitoring.

It has a RS232 interface for outputting the current measured values and changing of the parameter of the controller. This can also be used for direct control without the analog inputs. Only one control interface type is active, so if the controller is switched to RS232 input mode the Analog interface is deactivated.

3. dimensional drawing with pin assignment

Anschluss	Kabelseitig
Phase A	Kabelschuh M3 - 2,5mm²
Phase B	Kabelschuh M3 - 2,5mm²
Phase C	Kabelschuh M3 - 2,5mm²
Akku +	Kabelschuh M3 - 4mm²
Akku -	Kabelschuh M3 - 4mm²
RS 232 / Analog / Digital	Harwin m80-4611242
Sensor Motor	Harwin m80-4610642

MST 60-80	
Zulässige Versorgungsspannung	10 - 60V
Akkunennspannungsbereich	12 - 52V
Maximalstrom (kurzzeitig max 5s)	120A
Dauerstrom	von der Kühlung abhängig
Versorgungsspannung für Hallsensoren usw.	5V (max. 50mA)
Schutzklasse im Betrieb	IP40
Maximale Drehzahl elektrisch	240.000 1/min
Zwei digitale Eingänge zur Ansteuerung Zwei analoge Eingänge zur Ansteuerung	
Ein zusätzlicher Analogeingang zur Überwachung der Motortemperatur	
Eine RS232 Schnittstelle zur Ausgabe der aktuellen Messwerte und zur Parametrisierung der Steuerung. Diese kann auch zur direkten Ansteuerung ohne die Analogeingänge genutzt werden.	

(Zul. Abw.)	(Oberfl.)	Maßstab 1:2		Gewicht: ca. 230g
±0,5	Rz 16	(Werkstoff, Halbzeug) (Rohteil-Nr) (Modell- oder Gesenk-Nr)		

	Datum	Name
Bearb.	14.01.2019	Wüst
Gepr.		
Norm		

MST 60-80

Plettenberg Elektromotoren
Rostocker-Str.30
34225 Baunatal

10-014-000-001-01

Blatt

A4

| Zust. | Änderung | Datum | Name | (Urspr.) | (Ers. f.:) | (Ers. d.:) |

4.   Mounting and connection rules

If the controller is mounted in a closed case, the warm air must be replaced accordingly or cooled. At 80 A the dissipated heat is about 15 W!

On the top are five terminals with M3 threat (Max. torque is 1.3Nm), three of them are for the motor phase connections and two for battery plus and battery minus. There is also the 6 pole sensor connector and the 12 pole control connector on the top.

The motor phase A(U) should be connected with the red motor phase at Plettenberg motors.
The motor phase B(V) should be connected with the white motor phase at Plettenberg motors.
The motor phase C(W) should be connected with the blue/black motor phase at Plettenberg motors.

At the front plate 2 are the two battery cables and the 9 pole Sub-D connector for communication and the green status LED.

Caution: The sum of all battery cables (plus and minus) should be less than 1m. If several batteries are connected in series, the length of the connecting cables between the battery packs must be added to the battery cable length. For example, if you use 33cm battery cables length for the MST60-80 you have 100cm – 2 x 33cm = 34cm total cable length left for the battery pack. The allowed cable length depends also on the current, so if you are using the controller at higher currents than the nominal current, the allowed cable length is shorter. At 140A full throttle current the allowed cable length is 58cm, resulting in 29cm plus and 29 cm minus total.

Warning: Exceeding the permissible length of the battery wiring, the motor controller may be damaged. The motor controller is not protected against reverse polarity. If the battery is reversed, the motor controller may be damaged. Use an appropriate fuse (eg Littelfuse BF1 58V 100A 142.5631.6102, 142.7010.6102, MEGA-fuse 58V 100A) between the battery pack and controller. As a safety disconnect switch (emergency stop) we recommend Tyco Electronics KILOVAC EV100 and KILOVAC EV200 series.

A protective diode must be installed which, when the connection between the battery and the control unit is interrupted, draws the stored energy from the motor inductivity into the battery if current flows through the motor. The protective diode must be installed in parallel with the serial circuit fuse and safety disconnect switch. Anode to plus motor controller and cathode to battery plus. We recommend a VS-100BGQ100 or STPS80170CW diode to archive the best protection.

Warning: Never operate the controller with significant load on a power supply without permission from us. At partial throttle the input current of the controller could have high current spikes, which could cause overvoltage spikes, if using a power supply instead of a battery. These spikes can destroy the motor controller and/or the power supply. Never use the brake function, if using a power supply. **At braking the energy is feed**

back to the power supply, the resulting overvoltage may destroy the power supply and/or the controller.

Reversing the direction: If you want to reverse the main direction of rotation, swap the sensor cable A and B and the motor phases B with C. You can also use the digital reverse input for reversing the direction (recommended).

Please note that the possible cable length of the RS232 cable depends on the used line driver and the used cable. At cable length over 2m we recommend a shielded CAT5 cable for the RS232 connection.

5.   connectors and pin assignment

Please read the assembly instructions of the Harwin Datamate J-Tek series carefully:
https://cdn.harwin.com/pdfs/C005XX_M80_and_M83_Datamate_Series_Connectors.pdf
We recommend the crimp tool M22520/2-01 selector setting 6 with the positioner T5747/K1419.

Row1 uneven pin numbers, row2 even pin numbers
Sensor connector: M80-5100642 / M80-4610642
Pin assignment hall sensor and motor temperature sensor:
Pin1: Sensor-C   green
Pin2: +5V (20mA)   red
Pin3: Sensor-B   white
Pin4: GND   black
Pin5: Sensor-A   yellow or orange
Pin6: NTC (47k)   blue
The sensor cable shield should be connected with sensor GND. Do not connect the sensor cable shield with the motor case and/or with the motor controller case.

Control connector Harwin 12-pole: M80-5101242 / M80-4611242
Pin1: Brake input (aux), analog input 0-5V
Pin2: RxD
Pin3: TxD
Pin4: reverse switch (0V forward, 5V reverse)
Pin5: GND
Pin6: Throttle input, analog input 0-5V
Pin7: NC do not connect
Pin8: Impulse input, 5V Digital input
Pin9: +5V (30mA) Potentiometer supply
The shield of the RS232 cable should be connected with pin5 GND. Do not connect the shield with the motor case and/or with the motor controller case. Connect the shield only on one side of the cable.

For outdoor use, we recommend a Sub-D case with a gasket (e.g. RS720-3085).

6. Trouble free and safe operation

The sum of all battery cables (plus and minus together) and the connections between the battery cells must not exceed 1m. Warning: Exceeding the length of the battery wiring, the motor controller may be damaged. The motor controller is not protected against reverse polarity. Warning: If the battery is connected in reverse, the motor controller will be damaged. Use in the battery pack an appropriate fuse (eg Littelfuse BF1 58V 100A 142.5631.6102, 142.7010.6102, MEGA-fuse 58V 100A).

The 5V power supply can deliver a maximum of 50mA. If the Hall sensors of the motor need in total of 20mA, 30mA are left for accelerator and brake pedals are available. Therefore check the power consumption of these components.

Warning: Even a short-term short-circuit on the 5V supply at the control connector leads to the failure of the power supply of the Hall sensors. This can cause a defect at the motor controller if the engine is running.

7. Safety functions

Over voltage protection: At over 63V input voltage the MST controller switches off. If the input voltage rises over 66V the controller can be damaged.

Under voltage protection: Below 10V input voltage the MST controller switches of to protect the internal power supply voltages.

Motor temperature protection: If the motor temperature is exceed the motor temperature limit the MST controller switches off to protect the motor.

Controller temperature protection: If the controller temperature is exceed the controller temperature limit the MST controller switches off to protect the motor.

High pedal protection: To avoid that the controller went to full throttle in case the minus wire to the throttle potentiometer is broken, the MST controller switches off, if the voltage at the analog input exceed 4.95V for safety.

Start protection: To avoid that the motor starts unwanted at power on, the controller getting armed at power on after the throttle signal is at stop position.

Sensor error: If the positions sensors give faulty signals the MST controller switches off to protect the motor and the controller

8. Safety notes

Over 60V battery voltage you leave the range of the Safety Extra Low Voltage! The wiring must be carried out at supply voltages above 60V only by qualified persons. It must be considered the relevant technical standards. Touching the motor terminals with the engine running with more than 60V battery voltage can cause injuries. Therefore, the wiring has to be made at battery voltages over 60V that no power contacts can be touched.

If you have questions please do not hesitate to contact us (technik@plettenberg-motoren.com).

Be careful with motors driving rotating parts.
If drive battery pack is connected, never stand in the hazard area of the rotating parts! Technical defects in electrical and mechanical systems can lead to an unexpected start of the motor and / or loose parts can greatly hurt you or persons located nearby**! Only use the controller when property and personal damages are excluded!** We are not responsible for the use in passenger-carrying equipment (see section 16 Legal Terms and Conditions)!

The controller is not protected against reverse polarity and confusion.
Never mix up with PLUS MINUS (reverse polarity)! This results in damage to the controller!
Never connect the drive battery on the motor connecting cable (confusion), this can lead to irreparable damage!

Never operate the controller with significant load on a power supply without permission from us. At partial throttle the input current of the controller could have high current spikes, which could cause overvoltage spikes, if using a power supply instead of a battery. These spikes can destroy the motor controller and/or the power supply. Never operate the controller with a power supply, when using the braking function. At braking the energy is feed back to the power supply, the resulting overvoltage may destroy the power supply and/or the controller.

Do not connect an external voltage source at the 5V sensor supply. Exceeding 5.5V on this connection may cause damage to the controller.

Never disconnect the drive battery with the engine running from the controller. This may damage the controller. If you have activated the safety disconnect switch (emergency stop) with the engine running, so a test run of the controller with a current-limited power supply without load is necessary. Only if it is ensured that the controller is without damage, the controller can be put into operation again.

Never exceed the maximum length of the cables between the controller and battery (max. length 2x50 cm). All serial connections between the battery cells must be added to the battery cable length. If several batteries are connected in series, the length of the connecting cables between the battery packs must be added to the battery cable length. For example, if you use 33 cm battery cables length for the MST60-80 you have 100cm – 2 x 33cm = 34cm total cable length left for the battery pack. Exceeding the maximum length of the cables can cause damages to the controller. Also bad connectors and or bad crimps can cause damages to the controller!
Always disconnect the drive battery from the controller, if you do not use this longer period or if you want to charge the battery.
The monitoring functions can't detect every possible abnormal operating condition. The current limit does not protect the controller against short circuit between the motor cables. In case of a short circuit immediately switch off the motor to avoid permanent damage to the motor controller!

Also a current limitation at stalled motor will protect the motor only if the maximum allowed current of the motor is higher than the current limitation value of the controller. For example, if a 20A rated motor operated at the 60-80, the current monitoring in the case of blocking will not detect an excessive current and the motor may be destroyed.

9.   Initial operation of the drive system

For the first test of the wiring of the drive system, we recommend to use a current limited power supply. A power supply with an output voltage of 12 V will do the job. Run the motor only without load. At the first time please use only low throttle, if the motor is running rough or only vibrates, put the throttle back to zero and disconnect the battery cables.

Please check in this case the connection between the controller and the motor. There exist only 6 combinations to connect the motor phases:

Controller Phase A	Controller Phase B	Controller Phase C
Motor Phase A	Motor Phase B	Motor Phase C
Motor Phase B	Motor Phase A	Motor Phase C
Motor Phase C	Motor Phase A	Motor Phase B
Motor Phase A	Motor Phase C	Motor Phase B
Motor Phase B	Motor Phase C	Motor Phase A
Motor Phase C	Motor Phase B	Motor Phase A

After the MST controller is connected to the battery voltage the controller send on the RS232-Interface a small short instruction including the actual control parameters:

```
* Kommandoliste:
* 's'   Serieller Sollwert
* 'p'   Poti Sollwert
* 'i'   Impuls  Sollwert
* 'f'   Forward
* 'r'   Reverse
* '0'   Off
* 'b'   Brake
* 'm'   100% PWM(max)
* '9'   90% PWM
* '8'   80% PWM
* '7'   70% PWM
* '6'   60% PWM
* '5'   50% PWM
* '4'   40% PWM
* '3'   30% PWM
* '2'   20% PWM
* '1'   10% PWM
* '+'   +1% PWM
* '-'   -1% PWM
* 'g'   +0.1% PWM
* 'l'   -0.1% PWM
* 'w'   write setup
* 'h'   Help
```

```
MST60-80
Input = Analog
AnalogStop/Start/Full/BrakeMax =  500mV/ 549mV/4499mV/4499mV
ImpulsStop/Start/Full = 1150µs/1200µs/1900µs
For. Throttle Inc/Dec =  328  / 328
For. Throttle Max/Min =  100% /   3%
Rev. Throttle Inc/Dec =   66  / 328
Rev. Throttle Max/Min =  100% /   3%
Brake    Inc/Dec     =   66  / 328
Brake    Max/Min     =  100% /   5%
Voltage  Max/Min     =  60.0V/ 10.0V
Phase/BatteryAmp  Max = 120.0A/120.0A
Temp Max Motor/Power  = 100°C / 110°C
Motor RPM Limit      = 240000
Motor Polepairs      =   1
```

10. LED indicator functions

LED continuous light   : No error

LED 1x Blinking   : Error 0x0001 under voltage

LED 2x Blinking   : Error 0x0002 over voltage

LED 3x Blinking   : Error 0x0004 over current

LED 4x Blinking   : Error 0x0008 over temperature controller

LED 5x Blinking   : Error 0x0010 over temperature motor

LED 6x Blinking   : Error 0x0020 Motor blocked

LED 7x Blinking   : Error 0x0040 Sensor error

LED 9x Blinking   : Error 0x0100 Error Analog input(voltage too high)

LED 10x Blinking   : Error 0x0200 Error Impulse width

If more than one Error has happened the Error codes are added. For example if Error 0x0040 Sensor error and Error 0x0010 over temperature motor happen the controller shows Error 0x0050.

11. Standard Setup Values

Input   = Analog

AnalogStop/Start/Full/BrakeMax   = 500mV/ 549mV/4499mV/4499mV

Impuls Stop/Start/Full   = 1150µs/1200µs/1900µs

Throttle Expo For+Rev   = 0%

For. Throttle Inc/Dec   = 328 / 328

For. Throttle Max/Min   = 100% / 3%

Rev. Throttle Inc/Dec   = 66 / 328

Rev. Throttle Max/Min   = 100% / 5%

Brake   Inc/Dec   = 66 / 328

Brake   Max/Min   = 100% / 5%

Voltage Max/Min   = 60.0V/ 10.0V

Phase/BatteryAmp Max   = 120.0A/120.0A

Temp Max Motor/Power   = 100°C / 110°C

Motor RPM Limit   = 240000

Motor Polepairs   = 1

12. RS232-Interface-Parameters

115kbaud 8 Datenbits, no parity, 1 Stopbit.

13. RS232-Interface-Protocol-Description

Data on the RS232 interface in analog mode:

```
T=3.649V,a=0.000V,PWM= 787,U= 34.9V,I=  3.7A,RPM=  1482,con= 28°C,mot= 26°C
T=4.964V,a=0.000V,PWM=1000,U= 35.0V,I=  4.0A,RPM=  1896,con= 28°C,mot= 26°C
```

„T" means Throttle input, the big letter shows that it is active.

„a" means Aux input (Brake), the small letter shows that the brake is inactive at the moment as the throttle input has priority over the brake input.

„U" is the Input voltage

„I" is the Phase current (no average function and no synchronization with the commutation)

„RPM" is the motor speed in rpm

„con" is the controller temperature (power stage)

„mot" is the motor temperature

If the brake is active the "a" change to "A" and the "T" changes to "t":

```
t=0.000V,A=2.501V,PWM= 500,U= 35.0V,I=  0.0A,RPM=     0,con= 28°C,mot= 26°C
```


The Data on the RS232 interface in serial mode:

```
S=3.649V,a=0.000V,PWM= 787,U= 34.9V,I=  3.7A,RPM=  1482,con= 28°C,mot= 26°C
```

„S" shows that the serial control mode is active.

14. RS232-Interface-Commands

1 Byte Commands

"s":   switch to serial RS232 Input(lost after power down)

"p":   switch to analog input(Poti, lost after power down)

"i" :   switch to impulse input(compatible with model radio control, lost after power down)

"f":   forward

"r":   reverse

"0":   Motor off

"b":   Brake

"m":   100% PWM(maximum)

"9":   90% PWM

"8":   80% PWM

"7":   70% PWM

"6":   60% PWM

"5":   50% PWM

"4":   40% PWM

"3":   30% PWM

"2":   20% PWM

"1":   10% PWM

"+":   +1% PWM

"-":   -1% PWM

"g":   +0,1% PWM(V2 or higher)

"l":   -0,1% PWM(V2 or higher)

"t" :   activate 2s Timeout at the serial Interface(V2 or higher)

"h":   help

"a":   switch to adjust Mode

"e":   exit adjust Mode

2 Byte Commands (only in Adjust Mode)

"sd": set default

"sp": show parameter

"wp": write parms

"se": show the last 8 errors

5 Byte Commands (only in Adjust Mode)

"rp": RPM limit[1000RPM] "rp009" = 9000U/min, "rp100" = 100000U/min

"cl": current limit[A] "cl100" = 100A

"il": input current limit[A] "cl100" = 100A(V5 or higher)

"uv": under voltage [V] "uv020" = 20V

"ov": over voltage[V] "ov100" = 100V

"mt": motor temperature limit [°C] "mt100" = 100°C(V3 or higher)

"ct": controller temperature limit [°C] "ct080" = 80°C(V3 or higher)

"te": throttle expo curve in % "te000" = linear "te100" = 100% expo(V8 or higher)

"ti": throttle increase forward "ti001" = +1count/ms "ti010" = +10count/ms

"td": throttle decrease forward "td001" = -1count/ms "td010" = -10count/ms

"tl": throttle limit forward in % "tl100" = 100% "tl050" = 50%

"tm": throttle minimum forward in % "tm010" = 10% "tm050" = 50%

"ri": reverse throttle increase "ri001" = +1count/ms "ri010" = +10count/ms

"rd": reverse throttle decrease "rd001" = -1count/ms "rd010" = -10count/ms

"rl": reverse throttle limit in % "rl100" = 100% "rl050" = 50%

"rm": reverse throttle minimum in % "rm010" = 10% "rm050" = 50%

"bi": brake increase "bi001" = +1count/ms "bi010" = +10count/ms

"bd": brake decrease "bd001" = -1count/ms "bd010" = -10count/ms

"bl": brake limit [%] "bl100" = 100% "bl050" = 50%

"bm": brake minimum [%] "bm010" = 10% "bm050" = 50%

"af": analog input full throttle voltage "af450" = 4.50V

"ah": analog input halt motor voltage "ah050" = 0.50V

"as": analog input start motor voltage "as060" = 0.60V

"ab": analog input full brake voltage "ab500" = 5.00V(V5 or higher)

"if": impulse input full throttle "if200" = 2.0ms

"ih": impulse input halt motor "ih100" = 1.0ms

"is": impulse input start motor "is110" = 1.1ms

"pp": motor pole pairs count "pp001" = 2-Poles

"ot": output time RS232 [ms] "ot200" = 200ms (minimum 7ms) (V4 or higher)

RS232 Command examples

1. CR/LF is not necessary
2. After connecting the supply voltage to the MST60-80 controller the analog input is active by default. If you want to use the serial control input, you have to send „s" after the initialization of the controller.
Examples:
If you want to run the motor forward with 10% throttle PWM you send „1f".
If you want to increase the throttle PWM to 33% you send „3+++".
If you want to increase to maximum throttle you send „m".
If you want to switch off the motor current you send a „0".
If you want to brake with 10% brake PWM you send a „1b".
If you want to increase the brake PWM to 33% you send „3+++".
If you want to run the motor with 8% throttle PWM you send „1--r".
If you want to change a parameter you have to switch the MST into the adjust mode by sending an „a". That is only possible if the motor does not run.
For example if you want to change the pole pair count to 10 pole pairs(20 pole motor) that the MST sending the shaft speed instead of the electrical speed on the RS232 interface send an „a" for adjust mode, after that you send „pp010" for 10 pole pairs and „e" for exit adjust mode. If you want to store the changed parameter, you have to leave the adjust mode by sending a "wp" instead of the "e".

15. Sensor Phase Mapping

Commutation Sequence Forward

	Step1	Step2	Step3	Step4	Step5	Step6	Error1	Error2
Phase A(U)	+	Z	-	-	Z	+	Z	Z
Phase B(V)	Z	+	+	Z	-	-	Z	Z
Phase C(W)	-	-	Z	+	+	Z	Z	Z
Sensor A	1	1	0	0	0	1	0	1
Sensor B	0	1	1	1	0	0	0	1
Sensor C	0	0	0	1	1	1	0	1

Commutation Sequence Reverse

	Step1	Step2	Step3	Step4	Step5	Step6	Error1	Error2
Phase A(U)	-	-	Z	+	+	Z	Z	Z
Phase B(V)	Z	+	+	Z	-	-	Z	Z
Phase C(W)	+	Z	-	-	Z	+	Z	Z
Sensor A	1	1	0	0	0	1	0	1
Sensor B	0	0	0	1	1	1	0	1
Sensor C	0	1	1	1	0	0	0	1

Z: high impedance, +:Plus, -:Minus, 1:>3V, 0:<2V

16. Rechtliches

Es wird keine Haftung übernommen für Sach- und Vermögensschäden, sowie Sach- und Vermögensfolgeschäden:

- durch unsachgemäße Handhabung.
- an sämtlichen Fluggeräten wie Ultraleichtflugzeugen, Drachen, Fallschirmen, Flugmodellen, Raketen, Drohnen, Hängegleitern und Gleitseglern oder deren Teilen, sowie Schäden durch Grounding von o.g. Fluggeräten .
- an fremden Luftfahrzeugen oder Luftfahrzeugteilen
- durch Anwendungen aller Art, die dem deutschen Kriegswaffengesetz unterliegen.

Generell ausgeschlossen sind Vermögens- und Vermögensfolgeschäden.

Die Steuerung wurde nicht den für Flugzeugen vorgeschriebenen Sicherheits- und Dauertests unterzogen. Es wird keinerlei Haftung übernommen für Personen- bzw. Sachschäden, Sachfolge- und Vermögensschäden, sowie Vermögensfolgeschäden beim und durch den Betrieb in manntragenden Fluggeräten!

Im Zweifel holen Sie bitte eine schriftliche Zustimmung für den Betrieb in Ihrer speziellen Anwendung ein.

Grundsätzlich gelten unsere Allgemeinen Geschäftsbedingungen.

17. Disposal

A controller with exceeded service life is electronic scrap. E-scrap consists on the one hand of valuable materials which can be recovered as secondary raw materials and, on the other hand, it contains environmentally hazardous substances.

Information regarding optimum material recycling is available from commercial waste disposal companies.

18. Service / Contact

Should, despite proper handling and sufficient care, problems should still occur or the motor controller will be damaged, then please send the controller back to our address stating the problem, defect or damage.

Plettenberg Elektromotoren GmbH & Co. KG

Rostocker Straße 30

34225 Baunatal – Großenritte

Telefon: +49 (0) 56 01 / 97 96-0

Fax: +49 (0) 56 01 / 97 96-11

Internet: www.Plettenberg-Motoren.com

E-Mail: Info@Plettenberg-Motoren.com

19. EU-Declaration of Conformity

In the sense of the EU Directives

- **EMC Directive 2014/30/EU Appendix IV**
- **Low Voltage Directive 2014/35/EU Appendix IV**
- **RoHS Directive 2011/65/EU Appendix II**

$C\,\epsilon$

Plettenberg Elektromotoren GmbH & Co. KG

Rostocker Straße 30

34225 Baunatal – Großenritte

hereby declares, as the manufacturer, that the articles and objects described below comply with the provisions of the relevant community harmonisation legislation referred to above.

Gerätetyp	
MST 60/80	MST 80/350
MST 60/130	MST 140/200
MST 60/260	MST 400/133
MST 60/290	MST 400/200
MST 80/240	

Interference emission	EMC Directive Article 6 Appendix I.1.a
DIN EN 61000-6-3:2011-09	Electromagnetic Compatibility (EMC)- Part 6-3: Generic standards - Interference emission for residential areas, business and commercial areas as well as small businesses (IEC 61000-6-3:2006 + A1:2010); German Edition EN 61000-6-3:2007 + A1:2011
Interference immunity	**EMC Directive Article 6 Appendix I.1.b**
DIN EN 61000-6-1:2007-10	Electromagnetic Compatibility (EMC)- Part 6-1: Generic standards - Immunity for residential environments, business and commercial areas as well as small businesses (IEC 61000-6-1:2005);
Device safety	
DIN EN 60335-1:2012-10	Household and similar electrical appliances - Safety - Part 1: General requirements (IEC 60335-1:2010, modified);
DIN EN ISO 12100:2010	General principles for design - Risk assessment and risk mitigation ISO 12100:2010 (): German Edition EN ISO 12100

Maximum permissible concentrations in homogeneous materials in % by weight	RoHS Directive Appendix II
Lead	0,1%
Cadmium	0,01%
Polybrominated biphenyl (PBB)	0,1%
Polybrominated diphenyl ether (PBDE)	0,1%
Mercury	0,1%
Hexavalent chromium	0,1%

Note:

The sole responsibility for drawing up this declaration of conformity lies with the manufacturer. This declaration of conformity will lose its validity when the product is converted, extended or altered in any other manner without the express consent of Plettenberg Elektromotoren GmbH & Co. KG and when components, not belonging to Plettenberg Elektromotoren GmbH & Co. KG, or accessories are installed in the product as well as in the event of improper connection or improper use of the product.

Baunatal, den 01. 04. 2016   ....

(Uwe Plettenberg, Geschäftsführer)