Digital Controller

EBM-152070

- closed-loop and/or open-loop spreading
- precisely metered deposition rate
- recording of spread data, including a protocol for use with GPS
- good adaptability for interfa. with hydraulic system
- good adaptability for interfa. with spreading system
- ergonomic user interface
- customised versions can be supplied

1 Description

1.1 Brief description

The EBM-152070 digital controller is available for general sale. It is designed for use with any make of single- or twin-chamber salt spreader for winter road management.

The controller is intended for the following applications:

- Single-chamber unit with proportional liquid pump; a liquid proportion from 0% to 100% can be selected with a step switch
- Two-chamber unit with the facility for operating with blended materials
- Two-chamber unit with proportional liquid pump and additional on/off valve

All functions are controlled by a microcontroller. The system can be operated in ”closed loop” or ”open loop” modes, as well as in mixed mode. To fully exploit the advantages of the digital system (e.g. quantity measurements), the auger, belt and liquid pump should be run in closed-loop mode with this controller. If a function is controlled in open-loop mode, certain limitations in comparison to closed-loop mode must be accepted. Meter readings for both total and daily quantities of salt, liquid, sand and grit can be called up on a display. Further information on operating hours, spread distance, etc. can be provided. Interfaces for data transfer to a PC are also provided, as are the prerequisites for communication with GPS systems. Software for general-purpose salt/grit spreading is installed as standard. We can carry out application-specific modifications to suit customer preferences. The control panel can be laid out to suit the specific application and customer requirements.

2 Optional product functions

2.1 Spread-data recording

With the /01 option, the EBM-152070 digital controller maintains a record of entire spreading patrols. At what speed, and with what spread settings, was the vehicle driven? Was the flow of grit interrupted - and, if yes, by what? If suitable sensors are fitted, the EBM-152070 also accurately records the quantities deposited. Two protocols are available: the standard protocol and a GPS protocol. The standard protocol sends the recorded data via the serial interface to a printer or a PC data-capture program. This enables, for example, the invoicing justification for subcontractors to be gathered. (The design of the main protocol is explained in the Output Format section of the protocol specification.) Precise deposition means optimised use of the spread material and improved inventory management. Automatic fault detection ensures that vehicle defects can be rectified promptly. A GPS protocol is implemented; this can be used in vehicles that have a GPS reception system.

It not only captures and checks the spreading performance, but also provides planning and maintenance support to fleet managers, including visualisation of the routes patrolled. The data is recorded every 10 seconds. As well as determining positions, the distance driven and the exact geographical route patrolled can be established.

2.2 Thermo-CTR (option /03 & /04)

The surface temperature of the road can also be used to regulate the amount of spread material being deposited. This function is known as Thermo-CTR (controlled). In conjunction with a temperature sensor in the form of an infrared camera, the EBM-152070 with option /03 and /04 has 4 different automatic programs with which it can continuously meter the spread material. A minimum rate of deposition can be set. If the Thermo-CTR function is switched off, the normal spread function of the EBM 152070 is available.

3 Technical data

Characteristics		Description, value, unit
Supply voltage U_B		12 V ... 30 V DC, smoothed. Ripple < 10%
Inputs	2 analogue inputs	Actual value, spread-symmetry adjustment; R_i approx. 80 kΩ Actual value, Thermo-CTR (optional)
	4 frequency inputs	Impulse inputs for feedback signals (NPN sensors) from spinner, auger/belt and liquid pump. max. input frequency f_{max} = 1 kHz. input resistance R_i approx. 2 kΩ, aktiv low, U_{High} > 10 V, U_{Low} < 2 V
	1 frequency input	For sensor for road-speed signal. can be set for NPN or PNP sensors or inductive AC sources. factory setting PNP, max. input frequency f_{max} =1kHz, input resistance R_i approx. 10 kΩ, standard signal form to DIN 9684. (option: adapter for road-speed signal f_{max} > 1 kHz)
	4 on/off inputs (sensor inputs)	For spread-monitoring, brine empty and salt empty 1, salt empty 2 . NPN sensors: max. input frequency f_{max} = 1 Hz, input resistance R_i approx. 2 kΩ, active low, U_{High} > 10 V, U_{Low} < 2 V
Outputs	4 proportional outputs	For demand-signal presets for spinner, Transport 1 and Transport 2. maximum output current 2.5 A
	6 on/off outputs	For work headlights, warning beacons, wet salt, customer output (maximum current per output 5 A but max. combined total 10 A), and for spread symmetry left and spread symmetry right (additional output current max. 5 A)
Display		Graphic display, LCD display, illuminated
Outputs	Power supply + speed signal Actuators and sensors	42-pin plug HAN 42DD
Special features		Reverse-polarity protected supply voltage input terminal
Operating temperature		-40 °C ... +85 °C
Reference voltage		Approx. 10 V max. 200 mA for power supply
Control panel		back-lit
Option: serial interface		SUB-D 9, 2400, 4800, 9600, 19200
Protection class		IP30

Characteristics	Description, value, unit
Certificate of electromagnetic compatibility	CISPR 25 Broadband disturbances (Annex 7) CISPR 25 Narrowband disturbances (Annex 8) ISO / TR 10605 Immunity to electrostatic discharge (ESD) ISO 7637-2 Immunity to copled impulses; (Annex 10) ISO 7637-2 Emission of interferences pulses (Annex 10)
Dimensions	B = 243 mm, T = 199 mm, H = 105 mm
Weight	approx. 3,5 kg

4 Ordering code

4.1 Digital controller

	Designation	Part number
Standard unit	EBM-152070-DS-WINT	100031512

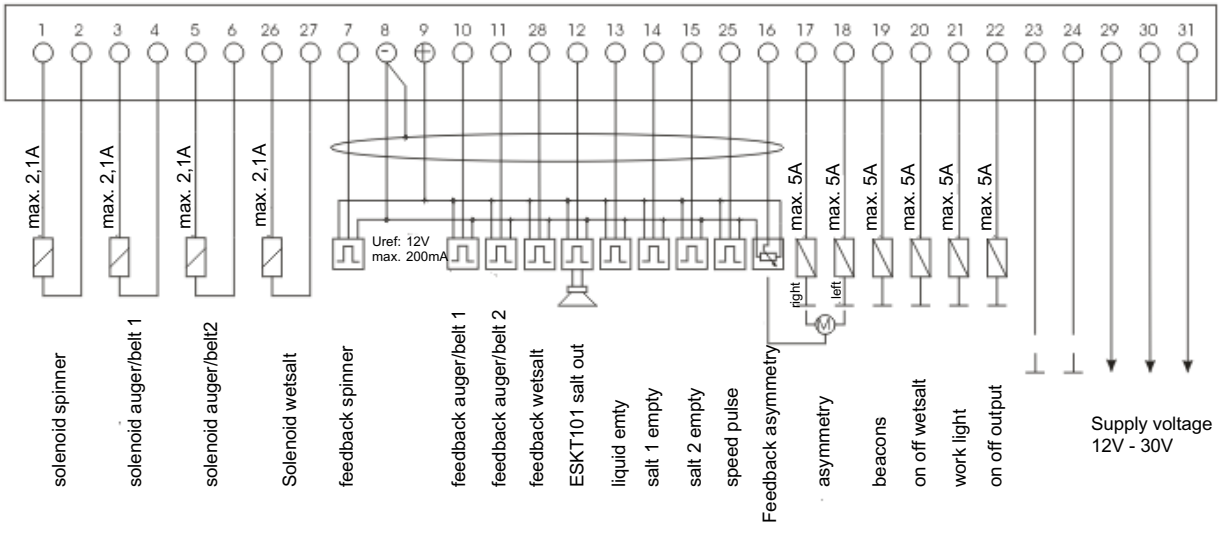
We can carry out application-specific and client-specific modifications, particularly to the software.

The control panel can also be customised with a customer logo or different scaling, for example.

4.2 Accessories

42-pinplag/socket connection	Part No.	Standard	Alternative	Optional
Line housing, HAN-DD42, straight, PG16	100.607910	●		
Plug insert HAN-DD42	100.607761	●		
Contact pin for 0.14 - 0.37 mm^2	100.217466		●	
Contact pin 0.5 mm^2	100.217467		●	

5 Connection diagram



6 Description of function

Key / Display	Function / Meaning
	**ON/OFF key** Switches the electronics on and off.
	**Spreading ON** This key switches the spreader on. The spinner plate starts to rotate at the set spread width, and the transport mechanisms are driven in accordance with the vehicle speed.
	**MENU** Change the functions of softkeys
	**STOP** Stops spreading operation. Transport mechanisms remain stationary, but the spinner isn't stopped.
	**MAX** Auger/belt transports total spread quantities, the speed of spinner doesn´t change.
	**Info key** By pressing i key repeatedly, the following values can be displayed: ROAD + DRIVER: displays the road and driver numbers that have been entered DAILY WORK HRS: daily working time in hours (in spreading mode) DAILY DISTANCE: daily distance travelled in km (in spreading mode) DAILY QTY SALT1: daily spread quantity of salt from Transport 1 in kg DAILY QTY SAND1: daily spread quantity of sand/grit from Transport 1 in kg DAILY SALT2/LIQD: daily spread quantity of salt/liquid from Transport 2 in kg 1) DAILY SAND2/LIQD: daily spread quantity of sand/liquid from Transport 2 in kg 1) DAILY LIQUID: daily spread quantity of liquid in kg WORKING HOURS: total working time in hours (in spreading mode) DISTANCE: total distance travelled in km (in spreading mode) QTY SALT 1: total spread quantity of salt from Transport 1 in kg QTY SAND 1: total spread quantity of sand/grit from Transport 1 in kg QTY SALT2: total spread quantity of salt from Transport 2 in kg 1) QTY SAND2: total spread quantity of sand from Transport 2 in kg 1) QTY LIQUID: : total spread quantity of liquid in kg 1) Assignment of liquid/admix corresponds to medium of transport 1.

Key / Display	Function / Meaning
 ERROR	**Fault messages** Audible and visible fault message for Container for Transport 1 empty — FILL LEVEL 1 (when enabled) Container for Transport 2 empty — FILL LEVEL 2 (when enabled) Liquid empty — LIQUID EMPTY! Incorrect feedback from the spinner — SPINNER ERROR! Incorrect feedback from Auger/Belt 1 — BELT/AUG1 ERROR Incorrect feedback from Auger/Belt 2 — BELT/AUG2 ERROR Incorrect feedback from spread symmetry — SPREAD SYM ERROR Spread monitoring — NO SPREADING! (when enabled) Incorrect spread width (out of range) — WIDTH ERROR The audible alarm signal can be switched off with the i key.
	**Spread-density selector switch 1 (Transport 1)** Densities of 0 - 40 g/m^2 for salt or 0 - 240 g/m^2 for sand/grit can be set with this rotary switch. Auger/Belt 1 can be controlled in accordance with the road speed in either closed- or open-loop mode. The material is preselected with the selector key. Different deposition rates can be set for salt and sand/grit (Index 1 in SETUP). In the case of wet salt (On/Off), the transport speed is lowered by the wet-salt reduction factor (-W-SALT), which is adjustable. During blended-materials operation, this density switch determines the total rate of deposition (see also spread-density selector switch 2). If a fault occurs (no feedback), the transporter current is reduced to 60% of its maximum value I_{max}. The fault message ”BELT/AUG 1 FAULT” appears on the display. After the audible fault alarm has been cancelled, Auger/Belt 1 can be operated again by pressing the i key on the control system once again. If fill-level sensor 1 is no longer covered (high level), the fault message ”FILL LEVEL 1” appears on the display. The output is not switched off. **Spread-density selector switch 2 (Transport 2)** Densities of 0 - 40 g/m^2 for salt or 0 - 240 g/m^2 for sand/grit can be set with this rotary switch. Auger/belt 2 or the liquid pump can be controlled by the road speed in either open- or closed-loop mode. The material is preselected with the selector key. Different deposition rates can be set for salt and sand/grit (Index 2 in SETUP). In the case of wet salt (On/Off), the rate of deposition is lowered by the wet-salt reduction factor (-W-SALT), which is adjustable. During blended-materials operation, and with a proportional liquid pump in the case of wet salt (e.g. controlling the liquid pump), the required blended quantity (0 to 40%) is set with the rotary switch, and the density of the blended material can be set in SETUP using the liquid density. (Example settings: Density 1 = 20 g/m^2; Density 2 = 35% Rate of deposition: Auger 1 = 13 g/m^2 (65%); Auger 2 = 7g/m^2 (35%). If a fault occurs (no feedback), the current to the auger/belt or liquid pump is reduced to 60% of its maximum value Imax. The fault message ”BELT/AUG 2 FAULT” appears on the display. After the audible fault alarm has been cancelled, the auger/belt or liquid pump can be operated again by pressing the i key on the control system once again. If fill-level sensor 2 is no longer covered (high level), the fault message ”FILL LEVEL 2” appears on the display but the output continues to be energised (only in Wet-Salt Mode: On/Off).
	**Spread-width selector switch (spinner)** The spread width that is required is set with this rotary switch. A spread-width range of 1 - 9 m or 3 - 12 m can be selected in SETUP. The spinner can be controlled in closed- or open-loop mode. For every spread width, the corresponding speed can be saved in the control system. As soon as the material Sand/Grit is selected for a particular Transport, the spinner speed can be altered by an adjustable factor. If a fault occurs (no feedback), the spinner current is reduced to I_{min} (SETUP value). The fault message SPINNER FAULT! appears on the display. After the audible fault alarm has been cancelled, the spinner can be operated again by pressing the i key on the control system once again.
	**Spread-symmetry adjustment** Two relay outputs are switched in a position-dependent manner with this stepless controller. The drive element can be an electric motor, or a hydraulic cylinder controlled by two on/off solenoid valves. The actual-value feedback is provided by a potentiometer that is mechanically coupled with the drive. If there has been no corresponding movement after 5 seconds, power to the drive is switched off. In the event of a fault, the fault message SPREAD SYM ERROR appears on the display. After the audible signal has been cancelled, the drive can be actuated in the open-loop operating mode by pressing the i key once again. By turning the controller fully to the right or left, the control system allows the drive to be operated in the corresponding direction for a maximum of 4 seconds without requiring any feedback signal. In SETUP, the function can be programmed for closed-loop or open-loop control, or disabled. In addition, both corner points of the adjustment range can be adjusted, as can the hysteresis of the positioning accuracy.

6.1 Setup - short menu

From software version 2.2, there is a facility for altering some setup parameters without opening the electronic system. If the ”ENTER” and ”ESC” keys are pressed simultaneously when the vehicle is stationary and spreading is switched off, then the specific densities of the materials, among other parameters, can be set. As in setup mode, the values are adjusted with the rotary switch for Density 1. The values can also be set in the setup mode.

7 Data logging

With the option /01 version of the unit, the operating data is recorded. Through a serial interface, the data can be either output directly by a printer, or transferred to a PC (or mobile data logger) for further processing. If the data is not output online, it is stored in an internal memory that retains its data even when the controller's power supply is switched off. As soon as the data has been output, it is automatically deleted. The data can also be deleted manually via the menu item ”Data buffer CLR”.

Technical data - interface:

RS232:	connecting cable 1:1
Baud Rate:	2400, 4800, 9600, 19200
Parity:	none
Data Bits:	8
Stop Bits:	1
Format:	ASCII text
Stecker:	SUB-D 9-pin connector

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Classification: 470.710.730