CONTROL UNIT

Instruction manual

Order. No.
9.5032.90.201 9.5032.91.201 9.5032.92.201 9.5032.91.211 9.5032.91.273

TABLE OF CONTENTS **Page**

1. GENERAL INFORMATION

The Control Unit essentially consists of the following components:

- Power Supply
- CPU with Wind-Interface (to connect a Combined Wind Transmitter with serial communication)
- RS 422 Interface for the LED Display
- RS 422 NMEA Data Interface (output) for NACOS and CUSTOMER
- RS 422 Data Interface (input) for NMEA HDT message (Gyro)
- RS 422 Data Interface (input) for NMEA VBW or VTG or VHW messages (Log)
- DAC Interface for analogue voltage output
- ADC Interface for analogue input
- Wind-Interface (to connect a Combined Wind Transmitter with parallel communication)

The control Unit connects the different components of the measurement unit with each other over a measurement system and processes the following parameters:

- Wind Speed
- Wind Direction
- Air temperature
- Rel. humidity
- Barometric pressure
- Transverse ground speed, longitudinal ground speed
- Transverse water speed, longitudinal water speed
- Heading (Gyro)
- Water speed (Log)

The Control Unit can identify hardware and software errors. It can also restart the program (LED "WD" lights up on the CPU) with the help of a RESET-logic (Watchdog) if the program run has malfunctioned. During normal operation, the LED "WD" on the CPU is off.

Malfunctions in the program run are detected with the aid of a triggerable RESET logic (Watchdog). The CPU is reset and all registers and memories are re-initialised.

There are 5 device alternatives:

	Device:	**9.5032. 90.201**	**9.5032. 91.201**	**9.5032. 92.201**	**9.5032. 91.211**	**9.5032. 91.273**
Interface	Telegram					
RS 422 Data Interface (LED)	WIMWV True	X	X	X	X	X
	WIMWV Relative	X	X	X	X	X
RS 422 NMEA Data Interface (NACOS)	WIMWD True	X	X	X	X	X
	WIMWV Relative	X	X	X	X	X
	WIMHU	X				
	WIMMB	X				
	WIMTA	X				
RS 422 NMEA Data Interface (CUSTOMER)	WIMWD True	X		X	X	
	WIMWV Relative	X		X	X	
	WIMHU	X				
	WIMMB	X				
	WIMTA	X				
RS 422 Data Interface (Log)	VDVBW (xxVBW) GPVTG (xxVTG) VMVHW (xxVHW)	X	X	X	X	X
RS 422 Data Interface (Gyro)	HEHDT (xxHDT)	X	X	X	X	X
ADC Interface for analogue input					X	
DAC Interface for analogue voltage output						X
Wind-Interface serial (mounted on CPU)		X	X	X	X	X
Wind-Interface parallel				X		

2. SERIAL WIND INTERFACE

This digital input wind interface adapts the different data transmitters having serial communication for wind direction to the bus system. The digital input values are transmitted to the wind interface card and, from there, are called up once a second by the processor from a buffer storage.
Either a separate data transmitter for the relative wind speed and for the relative wind direction or a combined wind transmitter can be connected to detect ground level, horizontal components of the wind vector in a measuring range between 0.3 and 50 m/s.
When the distance between the wind transmitter and the control electronics is not great, the electronics system supplies the wind transmitter (or wind transmitters) together with its heating system with power. At greater distances (over 50 m) between the wind transmitter and the control electronics, there is a drop in voltage on the lines, which leads to a reduced heating power. In this case, a terminal box with a heating transformer should be set up in the vicinity of the wind transmitter.

Control Unit with 2 wind interfaces (serial and parallel):

The Control Unit evaluates that interface, which senses the higher wind speed. The decision is made once a second and refers simultaneously to wind speed, wind direction and errors.

If a sensor (wind speed or/and wind direction) of one interface fails, then the Control Unit evaluates the information of the other interface. In this situation the Control Unit sets the status byte in the MWV-sentence (to LED-Display and NACOS-Interface(s)) for 10 seconds every minute to *not valid*. If the LED-Display is set to *Relative Wind,* then it shows every minute for 10 seconds the error *E13*.

If a sensor (wind speed or/and wind direction) in each interface fails, then the Control Unit sets the status byte in the MWV-sentence (to LED-Display and NACOS-Interface(s)) continuously to *not valid*. If the LED-Display is set to *Relative Wind,* then it shows continuously the error *E13*.

- Type of Leads
  21 pins Siemens - connector plug INPUT Combined Wind Transmitter (see Drawing 1 to Drawing 6)

Pin-№	Key	
a1	+5V	DC Power supply Wind Speed
a2	⊥	GND
a3	Π	Signal Wind Speed (Frequency)
b5	+5V	DC Power supply Wind Direction
b6	Cl	Clock Signal
b7	Da	Data Signal
c1	Hz	24 V AC/DC; ca. 20 W; electronically controlled
c2		
c3	Hz	
c4		
c7	PGND	Non-fused earth contact shield

3. ADC INTERFACE (Universal analogue interface)

- Input for Hygro-Thermo Transmitter 1.1005.48.960 and Baro Transmitter 506031
  - Pt100 platinum thermometer –30°C … +60°C with four wire connection,
  - Voltage 0…1 V corresponding to 0…100 % relative humidity,
  - Voltage 0…0,48 V corresponding to 945…1053 hPa barometric pressure.

- Type of interface
  Multiplexed analogue to digital converter (ADC) with conditioning amplifier and reference voltage.
- Update rate, resolution
  The ADC interface updates the data every second with a resolution of 12 bit.
- Type of Leads
  25 pins D - connector plug INPUT (see Drawing 1 to Drawing 6)

Pin-№	Key	
1	+15V	DC Power supply Hygro-Thermometer
2	⊥	
4	0-1V	0…1 V = 0…100 % Relative Humidity
6	A	Pt100 –30…+60 °C
7	a	
9	e	
10	E	
17	AGND	Analogue Ground
25	PGND	Non-fused earth contact shield

4. PARALLELL WIND INTERFACE

This digital input wind interface adapts the different data transmitters having parallel communication for wind direction to the bus system. The digital input values are transmitted to the wind interface card and, from there, are called up once a second by the processor from a buffer storage.
Either a separate data transmitter for the relative wind speed and for the relative wind direction or a combined wind transmitter can be connected to detect ground level, horizontal components of the wind vector in a measuring range between 0.3 and 50 m/s.

The output signals of the wind speed transmitter are raised by the switching voltage of one diode (approx. 0.7 V) against reference point ground (life zero); this makes it possible to detect defects in the transmitter or in the cable. The corresponding error message appears on the outputs and displays.

The control electronics does not supply the wind transmitter (or wind transmitters) at this input with heating power. If heating is needed, a terminal box with a heating transformer should be set up in the vicinity of the wind transmitter.

Control Unit with 2 wind interfaces (serial and parallel):

The Control Unit evaluates that interface, which senses the higher wind speed. The decision is made once a second and refers simultaneously to wind speed, wind direction and errors.

If a sensor (wind speed or/and wind direction) of one interface fails, then the Control Unit evaluates the information of the other interface. In this situation the Control Unit sets the status byte in the MWV-sentence (to LED-Display and NACOS-Interface(s)) for 10 seconds every minute to *not valid*. If the LED-Display is set to *Relative Wind,* then it shows every minute for 10 seconds the error *E13*.

If a sensor (wind speed or/and wind direction) in each interface fails, then the Control Unit sets the status byte in the MWV-sentence (to LED-Display and NACOS-Interface(s)) continuously to *not valid*. If the LED-Display is set to *Relative Wind,* then it shows continuously the error *E13*.

- Type of Leads
  25 pins D - connector plug INPUT (see Drawing 1 to Drawing 6)

Pin-№	Key	
1	+15V	DC Power supply Wind transmitter(s)
2	⊥	
3	Π	Signal Wind Speed (Frequency)
4	A	8 bit reflected GRAY Code
5	B	
6	C	
7	D	
8	E	
9	F	
10	G	
11	H	
25	PGND	Non-fused earth contact shield

5. SERIAL OUTPUT: RS 422 LED-DISPLAY

The data telegram of the acquired data is available at the serial output of the electronics for wind speed and wind direction in ASCII format for transmission to the LED display. The telegram contains two NMEA MWV-messages with both the relative, and the true wind. At the display you can select the relative or the true wind.

- Type of Interface:
  simplex, serial, asynchronous (RS 422)

- Transmitting cycle
  The transmitter electronics outputs a data telegram once a second.

- Transmission Parameters
  The following setting of the interface is programmed and can not be changed by the user:

Baud rate	:	4800	bit/s
Data length	:	8	bits
Parity	:	none	
Start-Bit	:	1	bit
Stop-Bit	:	1	bit

- Type of Leads:
  4-pole Tuchel plug connection (see Drawing 1 to Drawing 6)

Pin-No.		
1	Tx+	
2	Tx-	
3	GND	
4	PGND	non-fused earth contact shield

Serial output telegrams for LED-Display

The data telegrams have the following NMEA formats:

MWV True wind LED

Character	Key
$	Start of sentence
WI	Talker identifier: Weather instrumentation
MWV	Sentence identifier: Wind direction and speed
,	Separator (comma, Hex 2C)
ddd.d	Decimal value of the true wind direction in degrees
,	Separator (comma, Hex 2C)
T	True wind
,	Separator (comma, Hex 2C)
ss.s	Decimal value of the true wind speed in m/s
,	Separator (comma, Hex 2C)
M	Unit: meter / second
,	Separator (comma, Hex 2C)
A (V)	Status: A = data valid, V = not valid
*	Checksum identifier (Hex 2A)
H	Checksum high byte
L	Checksum low byte
<CR>	Carriage return (Hex 0D)
<LF>	Line Feed (Hex 0A)

MWV Relative wind LED

Character	Key
$	Start of sentence
WI	Talker identifier: Weather instrumentation
MWV	Sentence identifier: Wind direction and speed
,	Separator (comma, Hex 2C)
ddd.d	Decimal value of the relative wind direction in degrees
,	Separator (comma, Hex 2C)
R	Relative wind
,	Separator (comma, Hex 2C)
ss.s	Decimal value of the relative wind speed in m/s
,	Separator (comma, Hex 2C)
M	Unit: meter / second
,	Separator (comma, Hex 2C)
A (V)	Status: A = data valid, V = not valid
*	Checksum identifier (Hex 2A)
Character	Key
H	Checksum high byte
L	Checksum low byte
<CR>	Carriage return (Hex 0D)
<LF>	Line Feed (Hex 0A)

- All characters are transmitted in ASCII codes
- Leading zeros are transmitted
- The decimal value of the true wind direction is referenced to the vessel (ship) unless the S3 code-switch on the CPU-board is set to “True wind referenced to earth” (open).
- The checksum is calculated by XOR-operation with all characters between the $ and the * (each exclusively). If the XOR-operation with all these characters (for example) results in the hexadecimal value 7E, then the ASCII characters "7" (Hex 37) as high byte and "E" (Hex 45) as low byte will be sent out.
- If the status of a decimal value is not valid, no decimal values are sent. In this case two separators (“,”) follow one after the other.
- Different from a normal NMEA sentence, the status can be set to “a” (lower case letter instead of an upper case letter). This character is used to control the LED-Display when the external switch true/relative wind is used.
- The two telegrams are transmitted once a second. First the relative wind and with a delay of 50 ms after the end of the first telegram the true wind is transmitted.

6. SERIAL OUTPUT: RS 422 NMEA 0183 V 2.0 DATA INTERFACE (S)

- Type of Interface
  simplex, serial, asynchronous (RS 422)

- Transmitting cycle
  The transmitter electronics outputs a data telegram once a second.

- Transmission Parameters (see Position of the DIP Switch on page 9 and parameters on page 10)
  The transmission parameters can be set individually for each channel of the interface. To do this, unplug the instrument from the supply voltage and pull the Multicom interface out of the transmission electronics.

  The parameters are 8 N1 or 7E1

  150…19200 Baud

  Baud rates are adjustable and have been set at the factory to 4800 bit/s.

- Type of Leads
  5 or 7 pole Tuchel plug connection (see Drawing 1 to Drawing 6)

  Pin-No
  1 TX+
  2 TX-
  3 GND signal ground
  4 PGND non-fused earth contact shield
  5-7 not used

The data telegrams have the following NMEA formats:

MWV Relative wind

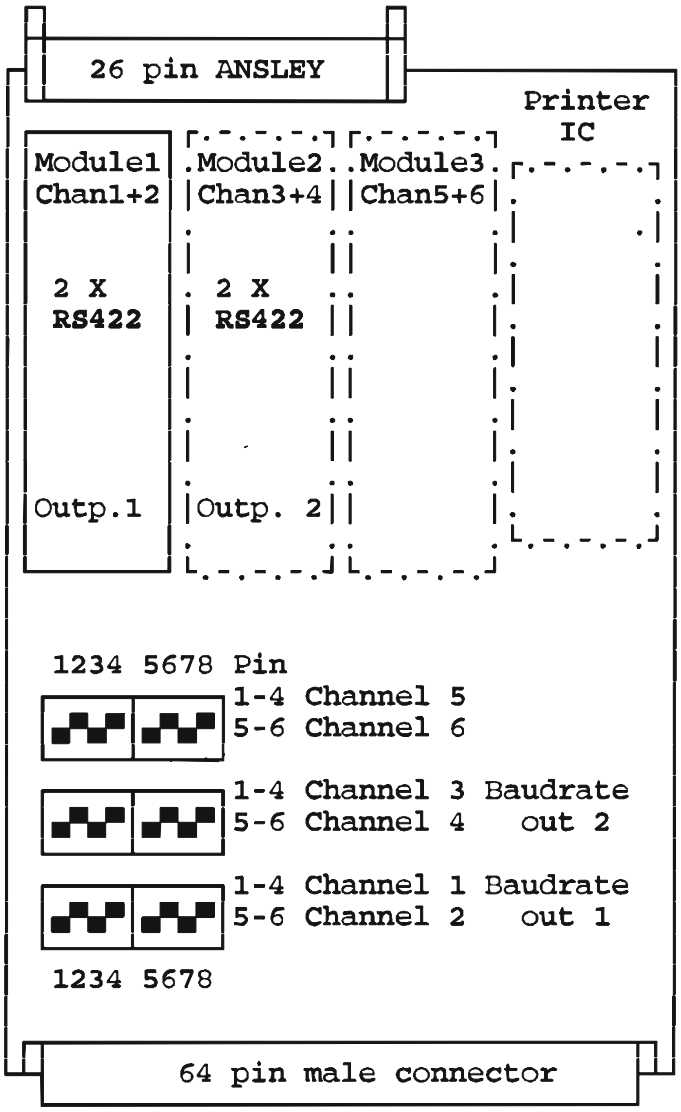
Character	Key
$	Start of sentence
WI	Talker identifier: Weather instrumentation
MWV	Sentence identifier: Wind direction and speed
,	Separator (comma, Hex 2C)
ddd.d	Decimal value of the relative wind direction in degrees
,	Separator (comma, Hex 2C)
R	Relative wind
,	Separator (comma, Hex 2C)
ss.s	Decimal value of the relative wind speed in m/s
,	Separator (comma, Hex 2C)
M	Unit: meter / second
,	Separator (comma, Hex 2C)
A (V)	Status: A = data valid, V = not valid
*	Checksum identifier (Hex 2A)
H	Checksum high byte
L	Checksum low byte
<CR>	Carriage return (Hex 0D)
<LF>	Line Feed (Hex 0A)

MWD True wind

Character	Key
$	Start of sentence
WI	Talker identifier: Weather instrumentation
MWD	Sentence identifier: Wind direction and velocity, surface
,	Separator (comma, Hex 2C)
ddd.d	Decimal value of the true wind direction in degrees
,	Separator (comma, Hex 2C)
T	True wind
,	Separator (comma, Hex 2C)
,	Separator (comma, Hex 2C)
M	Mag.
,	Separator (comma, Hex 2C)
,	Separator (comma, Hex 2C)
N	Unit: knots
,	Separator (comma, Hex 2C)
sss.s	Decimal value of the true wind speed in m/s
,	Separator (comma, Hex 2C)
M	Unit: m/s
*	Checksum identifier (Hex 2A)
H	Checksum high byte
L	Checksum low byte
<CR>	Carriage return (Hex 0D)
<LF>	Line Feed (Hex 0A)

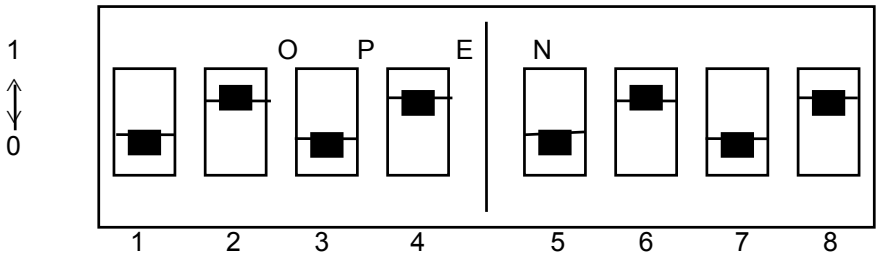
- All characters are transmitted in ASCII codes
- Leading zeros are transmitted
- The decimal value of the true wind direction is referenced to the vessel (ship) unless the S1 code-switch on the CPU-board is set to “True wind referenced to earth” (open).
- The checksum is calculated by XOR-operation with all characters between the $ and the * (each exclusively). If the XOR-operation with all these characters (for example) results in the hexadecimal value 7E, then the ASCII characters "7" (Hex 37) as high byte and "E" (Hex 45) as low byte will be sent out.
- If the status of a decimal value is not valid, no decimal values are sent. In this case two separators (“,”) follow one after the other.
- The telegrams are transmitted once a second in the above given order. After a delay of 50 ms after the end of the preceding telegram the next telegram is transmitted.

Position of the DIP Switch on the Multicom Assembly



Parameters to set the Serial Interface

Position of the DIP switch on the Multicom interface
Switch in Pos. OPEN = 1
Switch in Pos. CLOSED = 0



	Channel 1				Channel 2			
	Baud rate	Baud rate		Parity	Baud rate			Parity
	19200 Bit/s	0	0 0	X	0	0 0		X
	9600 Bit/s	1	0 0	X	1	0 0		X
*	4800 Bit/s	0	1 0	X	0	1 0		X
	2400 Bit/s	1	1 0	X	1	1 0		X
	1200 Bit/s	0	0 1	X	0	0 1		X
	600 Bit/s	1	0 1	X	1	0 1		X
	300 Bit/s	0	1 1	X	0	1 1		X
	150 Bit/s	1	1 1	X	1	1 1		X
	Switch	1	2 3	4	5	6 7		8

Parameters: X = 1 8 bit word, no parity, 1 stop bit (8N1)
X = 0 7 bit word, even parity, 1 stop bit (7E1)

* Default: 4800 8N1

7. SERIAL INPUT: RS422 NMEA 0183 V 2.3 DATA INTERFACE (LOG/GYRO)

VBW, VTG, VHW and HDT MESSAGES

- Type of interface
  Simplex, serial, asynchronous (RS422)

- Receiving cycle
  The serial input interface scans the received data every second using a timeout of 5 seconds. A maximum input rate of 5 telegrams per second is tested.

- Interface parameters
  The interface parameters can be set individually for each interface.
  Baud rate: 150 to 19200 Baud Default: 4800
  Transmission: 8N1, 7E1 Default: 8N1
  See: "Position of the DIP switch on the Multicom Assembly" on page 9
  and "Parameters to set the serial interface" on page 10

- Type of Leads (see Drawing 1 to Drawing 6)
  6-pole *Tuchel* plug connection GYRO (HDT sentence)
  8-pole *Tuchel* plug connection LOG (VBW, VTG, VHW sentence)

Pin-№	Key
1	RXD+
2	RXD-
3	GND signal ground
4	PGND non-fused earth contact shield
5-6 (8)	Not connected

The data telegrams have the following NMEA formats:

VBW Velocity bottom water

Character	Key	
$	Start of sentence	
VD	Talker identifier: Evaluation dependent on switch S4 (page 16)	
VBW	Sentence identifier: Velocity bottom water	
,	Separator (comma, Hex 2C)	
xx.x	Decimal value of the longitudinal water speed in knots	
,	Separator (comma, Hex 2C)	
xx.x	Decimal value of the transversal water speed in knots	
,	Separator (comma, Hex 2C)	
A	Status: A = data valid, every other character = not valid	
,	Separator (comma, Hex 2C)	
xx.x	Decimal value of the longitudinal ground speed in knots	
,	Separator (comma, Hex 2C)	
xx.x	Decimal value of the transversal ground speed in knots	
,	Separator (comma, Hex 2C)	
A	Status: A = data valid, every other character = not valid	
,	Separator (comma, Hex 2C)	
xx.x	Decimal value of the Stern transverse water speed	Not evaluated
,	Separator (comma, Hex 2C)	

Character	Key	
A	Status: stern water speed	
,	Separator (comma, Hex 2C)	
xx.x	Decimal value of the Stern transverse ground speed	Not evaluated
,	Separator (comma, Hex 2C)	
A	Status: Stern ground speed	
*	Checksum identifier (Hex 2A)	
H	Checksum high byte	
L	Checksum low byte	
<CR>	Carriage return (Hex 0D)	
<LF>	Line Feed (Hex 0A)	

VTG Track and ground speed

Character	Key
$	Start of sentence
GP	Talker identifier: Evaluation dependent on switch S4 (page 16)
VTG	Sentence identifier: Track and ground speed
,	Separator (comma, Hex 2C)
xx.x	Decimal value of the track relative to true north in degrees
,	Separator (comma, Hex 2C)
T	T = Track is relative to true north
,	Separator (comma, Hex 2C)
,	Separator (comma, Hex 2C)
M	M = Track is relative to magnetic north
,	Separator (comma, Hex 2C)
xx.x	Decimal value of the ground speed
,	Separator (comma, Hex 2C)
N	Unit: knots
,	Separator (comma, Hex 2C)
,	Separator (comma, Hex 2C)
K	Unit: km/h
*	Checksum identifier (Hex 2A)
H	Checksum high byte
L	Checksum low byte
<CR>	Carriage return (Hex 0D)
<LF>	Line Feed (Hex 0A)

VHW Heading and water speed

Character	Key
$	Start of sentence
VH	Talker identifier: Evaluation dependent on switch S4 (page 16)
VHW	Sentence identifier: Heading and water speed
,	Separator (comma, Hex 2C)
xx.x	Decimal value of the heading relative to true north in degrees
,	Separator (comma, Hex 2C)

T	T = heading is relative to true north
,	Separator (comma, Hex 2C)
,	Separator (comma, Hex 2C)
M	M = Mag.
,	Separator (comma, Hex 2C)
xx.x	Decimal value of the water speed
,	Separator (comma, Hex 2C)
N	Unit: knots
,	Separator (comma, Hex 2C)
,	Separator (comma, Hex 2C)
K	Unit: km/h
*	Checksum identifier (Hex 2A)
H	Checksum high byte
L	Checksum low byte
<CR>	Carriage return (Hex 0D)
<LF>	Line Feed (Hex 0A)

HDT Heading true

Character	Key
$	Start of sentence
HE	Talker identifier: Evaluation dependent on switch S4 (page 16)
HDT	Sentence identifier: Heading and water speed
,	Separator (comma, Hex 2C)
xx.x	Decimal value of the heading relative to true north in degrees
,	Separator (comma, Hex 2C)
T	T = heading is relative to true north
*	Checksum identifier (Hex 2A)
H	Checksum high byte
L	Checksum low byte
<CR>	Carriage return (Hex 0D)
<LF>	Line Feed (Hex 0A)

- All characters are evaluated as ASCII codes
- The “frame” of the above listed characters in each telegram is obliging. The length of the included decimal values is variable and there may be included some more characters just before the checksum identifier, but the maximum number of characters must not exceed 100 (VBW, VHW) respectively 50 (HDT). Maximal 4 successive characters in the decimal value will be evaluated.
- The checksum is calculated by XOR-operation with all characters between the $ and the * (each exclusively). If the XOR-operation with all these characters (for example) results in the hexadecimal value 7E, then the ASCII characters for the checksum should be "7" (Hex 37) as high byte and "E" (Hex 45) as low byte.
- A decimal value is assumed to be valid, if
    - the inspection of the “frame” and the checksum is successful,
    - the conversion of the appropriate characters to a decimal value is successful,
    - and the related status byte (if there is any) is an “A”.

- Missing values (no characters between the separators or their conversion to a decimal value did not succeed):
  Missing values are treated as errors with the following exceptions:

The transversal water speed is assumed to be zero if this value is missing in the VBW sentence.
The transversal ground speed is assumed to be zero if this value is missing in the VBW sentence.

8. ANALOGUE OUTPUT: DAC INTERFACE

4 Voltages 0…5 V for each relative and true wind, speed and direction.

- Type of interface
  4 Digital to analogue converters (DAC) with voltage output.

- Update rate, resolution
  The DAC interface updates the data every second with a resolution of 10 bit.

- Type of Leads
  25 pins D - connector plug OUTPUT Analogue 0…5 V (see Drawing 1 to Drawing 6)

Pin-№	Key	
1	+	0…5 V = 0…50 m/s Relative Wind
2	-	
4	+	0…5 V = 0…360 ∠° Relative Wind
5	-	
6	+	0…5 V = 0…50 m/s True Wind
7	-	
9	+	0…5 V = 0…360 ∠° True Wind
10	-	
25	PGND	Non-fused earth contact shield
2, 5, 7, 10	GND	Common System Ground
3, 8, 11…24		Not connected

- Load
  Min. Load 1500 Ω, short-circuit proof.

9. Calculation of the TRUE WIND

Definitions

- *Reference to earth*
  The earth's directional reference frame has true north corresponding to zero degrees with angles increasing in a clockwise direction.
- *Reference to ship*
  The ship's directional reference frame has zero degrees at the bow of the vessel with angles increasing in a clockwise direction.
- *Course over ground COG)*
  Direction (relative to true north) the vessel actually moves over the fixed earth.
- *Speed over ground (SOG)*
  The speed at which the vessel actually moves in the direction of COG.
- *Heading*
  Direction to which the bow is pointing relative to true north.
- *Speed over water (SOW)*
  The water-relative motion of a ship is a vector with components along (longitudinal) and perpendicular (transversal) to the axis of the ship.
- *Water motion (WM)*
  The motion of the water referenced to the fixed earth.
- *Log*
  Speed over water of the vessel in the direction of heading.
- *Relative wind*
  The platform-relative wind vector measured relative to the ship.
- *Wind direction*
  The direction *from* which the wind is blowing.
- *True wind*
  A wind vector with a speed referenced to the fixed earth and a direction referenced to either the fixed earth or to the bow of the ship.

Calculations

The vector *relative wind speed* ($\overrightarrow{RWS}$) is composed of the two vectors *speed over ground* ($\overrightarrow{SOG}$) *and true wind speed* ($\overrightarrow{TWS}$):

$$\overrightarrow{RWS} = \overrightarrow{SOG} + \overrightarrow{TWS} .$$

Here the RWS is measured with an Anemometer and a wind vane on the ship, the SOG is transmitted with the serial interfaces and the TWS has to be calculated:

$$\overrightarrow{TWS} = \overrightarrow{RWS} - \overrightarrow{SOG} .$$

This subtraction of vectors is done in an orthogonal coordinate system fixed to the ship.

The steps of the calculation are:
- Resolve the vectors (if necessary) into orthogonal components,
- Subtract the related components,
- Convert into polar coordinates.

The result of the calculation is the *norm of the true wind speed* and the *true wind direction referenced to the ship* (TWDS). The *true wind direction referenced to the earth* (TWDE) is calculated by adding the *heading* (HDG):

$$TWDE = TWDS + HDG .$$

Approximations

The vector of *speed over ground* ($\overrightarrow{SOG}$) is composed of the two vectors *speed over water* ($\overrightarrow{SOW}$) and *water motion* ($\overrightarrow{WM}$):

$$\overrightarrow{SOG} = \overrightarrow{SOW} + \overrightarrow{WM}$$

The complete vector of SOG is given in the telegram VBW with the components longitudinal and transversal ground speed.

- If the complete vector SOG is not valid (or missing), the true wind is approximated by substituting SOG with its longitudinal component or SOW. This procedure is allowed, if the water motion WM is negligible regarding the speed over water SOW. But of course, the condition cannot be checked.

The complete vector of SOW is given in the telegram VBW with the components longitudinal and transversal water speed. The longitudinal component of the vector SOG is given in the telegram VTG with the longitudinal ground speed.

- If the complete vector SOW is not valid (or missing), the true wind is approximated by substituting SOG with SOW and neglecting the transversal component of SOW. This procedure is allowed, if the water motion WM is negligible regarding the speed over water SOW and the transversal component is negligible regarding the longitudinal component of the water speed. But of course, the condition cannot be checked.

The longitudinal component of the vector SOW is given in the telegram VHW with the longitudinal water speed (Log).

ERRORS

Both components (speed and direction) of the true wind vector are not valid if:
- One component (speed or direction) of the relative wind is not valid, or
- the *longitudinal* component of the speed over ground or its approximation is not valid. If the *transversal* component of the speed over ground or its approximation is not valid, the value is assumed to be zero.

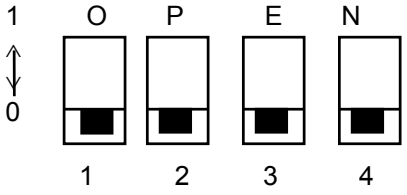
Additionally both components (speed and direction) of the true wind vector referenced to earth are not valid if:
- The heading messages in both the HDT and VHW telegrams are not valid.

The true wind vector referenced to ship does not need a heading message.
If both telegrams VBW or VTG and VHW give speed over ground or its approximation, the calculation is done with the speed from the VBW telegram.
If both telegrams HDT and VHW give the heading message, the calculation is done with the heading from the HDT telegram.

SELECTIONS

The reference (ship/earth) of the true wind direction is selected individual for the two serial outputs (LED, NMEA) by setting a DIP switch on the CPU board. See the position of the DIP switch in the figure “CPU Card (Mounting Side)” in the appendix on page 18.

Switch		Key	Affected interface
S1	Closed	True wind referenced to ship (default)	NMEA NACOS
	Open	True wind referenced to earth	
S2	Closed	True wind referenced to ship (default)	NMEA CUSTOMER
	Open	True wind referenced to earth	
S3	Closed	True wind referenced to ship (default)	NMEA LED
	Open	True wind referenced to earth	
S4	Closed	Talker identifier evaluated (default)	NMEA LOG/GYRO
	Open	Talker identifier not evaluated	



Default setting of the DIP switch on the CPU-board

10. APPENDIX

Position of the printed circuit boards

* See Drawing 4 to Drawing 6 *

BOARD ASSIGNMENT			
BOARD	TYPE/FUNCTION	ADDRESS	CHANNEL
K1	Power Supply Board +5, ±15 V=		
K2	CPU-board EPROM 1 RAM 1 8 Bit Serial Wind Interface	 0000 8000 0020	 2
K3	Universal-Analogue-Interface	E000	3
K4	Multicom-Interface	E200	4
K5	DAC Interface	E800	4
K6	8 Bit Parallel Wind Interface	F800	1
K7	Baro-Transmitter	---	1

Supplementary Information

Inputs: Serial Wind interface

Wind Speed	:	Pulse transmitter	:	0...1052 Hz
		Meas. range	:	0,3...50,0 m/s
		Resolution	:	0,1 m/s
Wind Direction	:	Code Transmitter	:	8-bit serial
		Meas. range	:	0...360 Degrees
		Resolution	:	2,5 Degrees
Transmitter Power Supply	:	+5 V =		
Heater		24 V/ 50 Hz		max. 40 VA
Connecting cable	:	LiYCY 12x 0,75 mm²		
Max. Length	:	for heating supply From AWS: ca. 50 m With a separate heating transformer: Approx. 500 m		

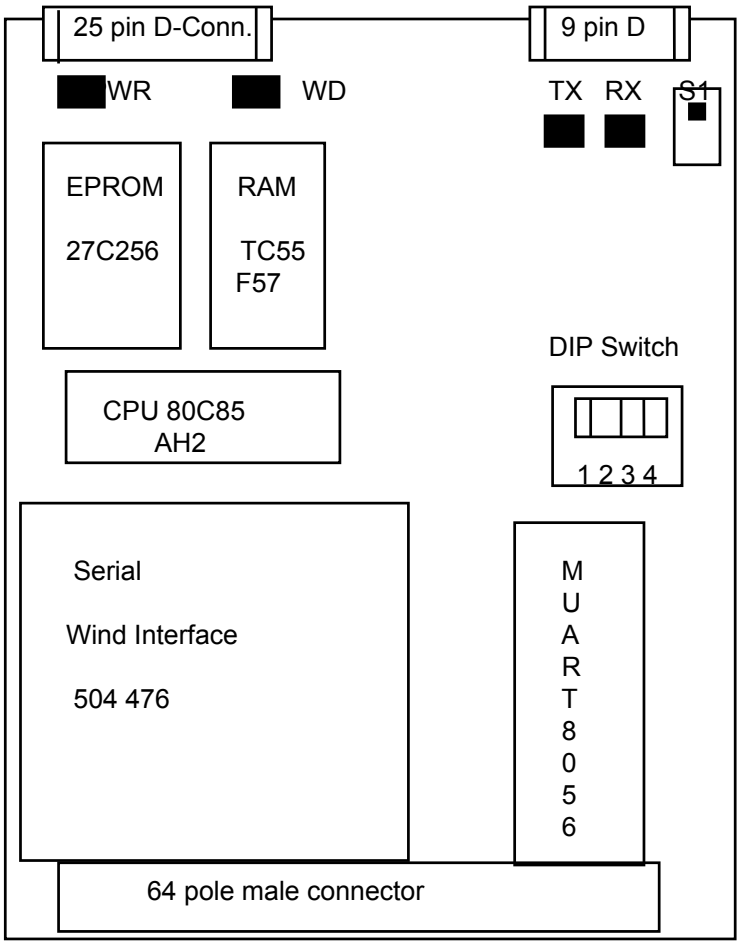
The station has its own transformer, which supplies power to heat the transmitter. However, if the transmitter is more than 50 m away from the Control Unit, then an external heating transformer must be used.

Inputs: Parallel Wind interface

Wind Speed	:	Pulse transmitter	:	0...1052 Hz
		Meas. range	:	0,3...50,0 m/s
		Resolution	:	0,1 m/s
Wind Direction	:	Code Transmitter	:	8-bit parallel reflected GRAY Code
		Meas. range	:	0...360 Degrees
		Resolution	:	2,5 Degrees
Transmitter Power Supply	:	+15 V =		

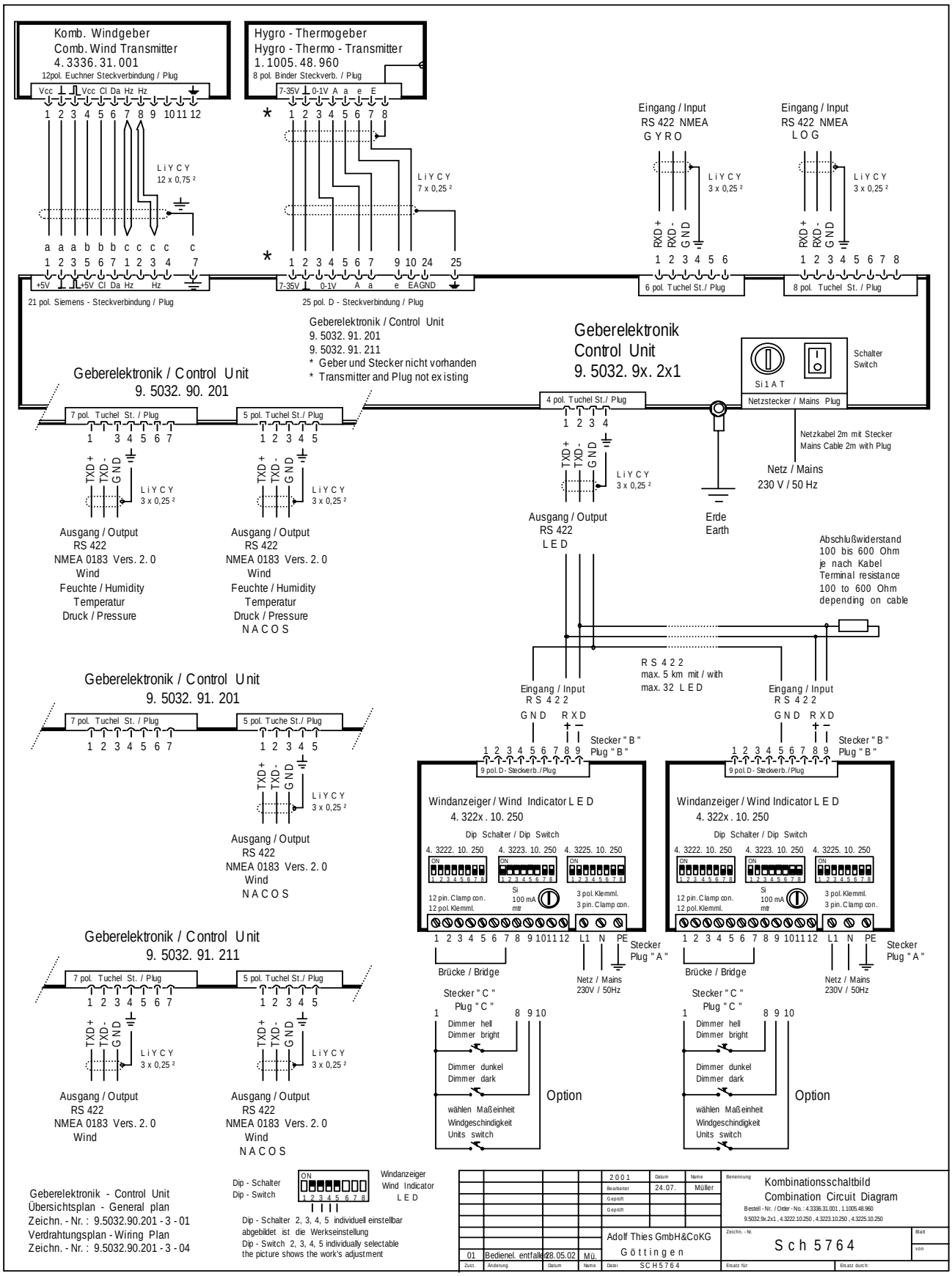
Signal voltage (Speed and direction): Equals power supply at no load
Life Zero voltage (Speed and direction): 0,7 V

CPU Card (Mounting Side)



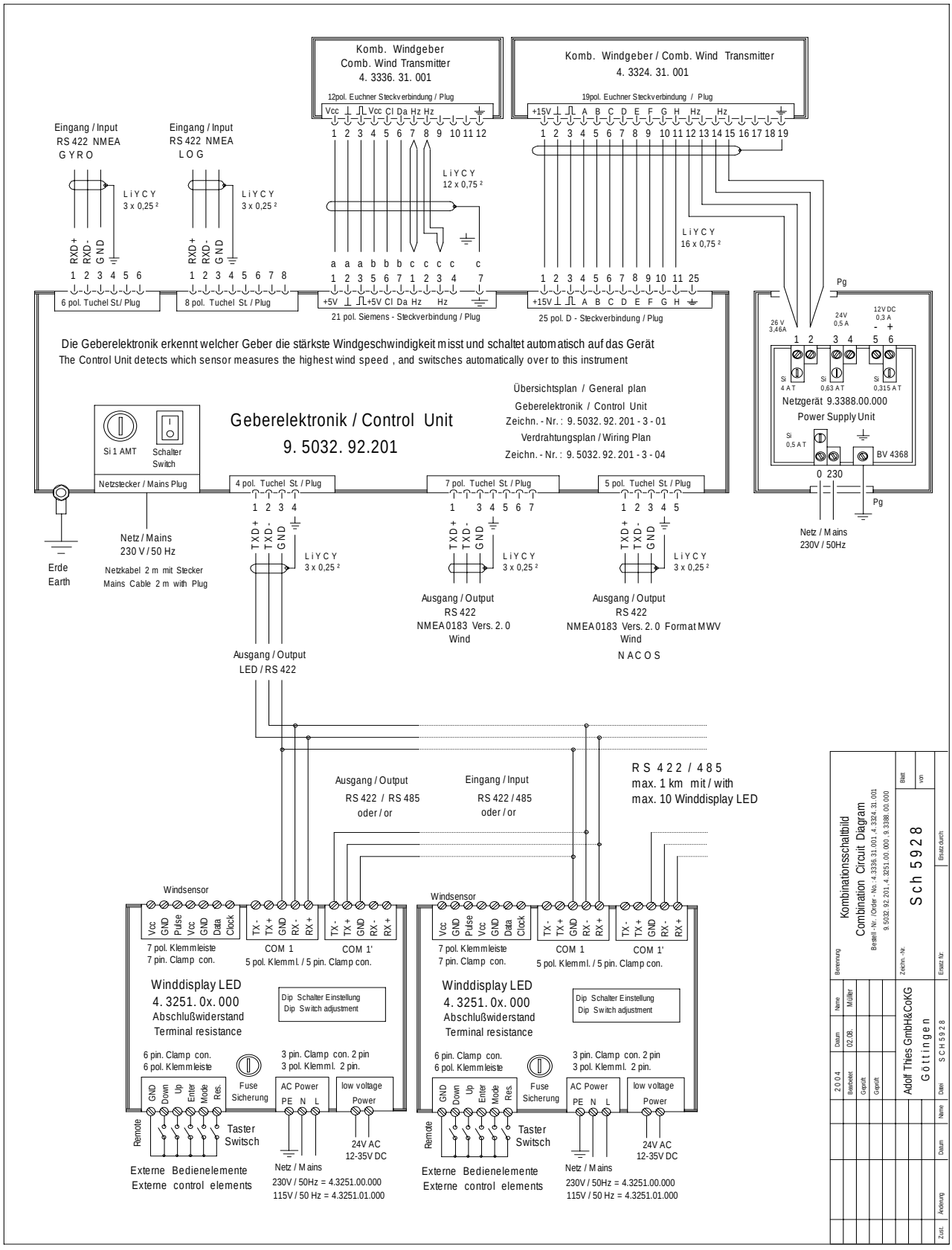
LED WD = Watchdog red
LED PWR = Power on green
LED TX = Transmit red
LED RX = Receive red

Combination Circuit Diagram for Control Units 9.5032.91.201, 9.5032.90.201, 9.5032.91.211



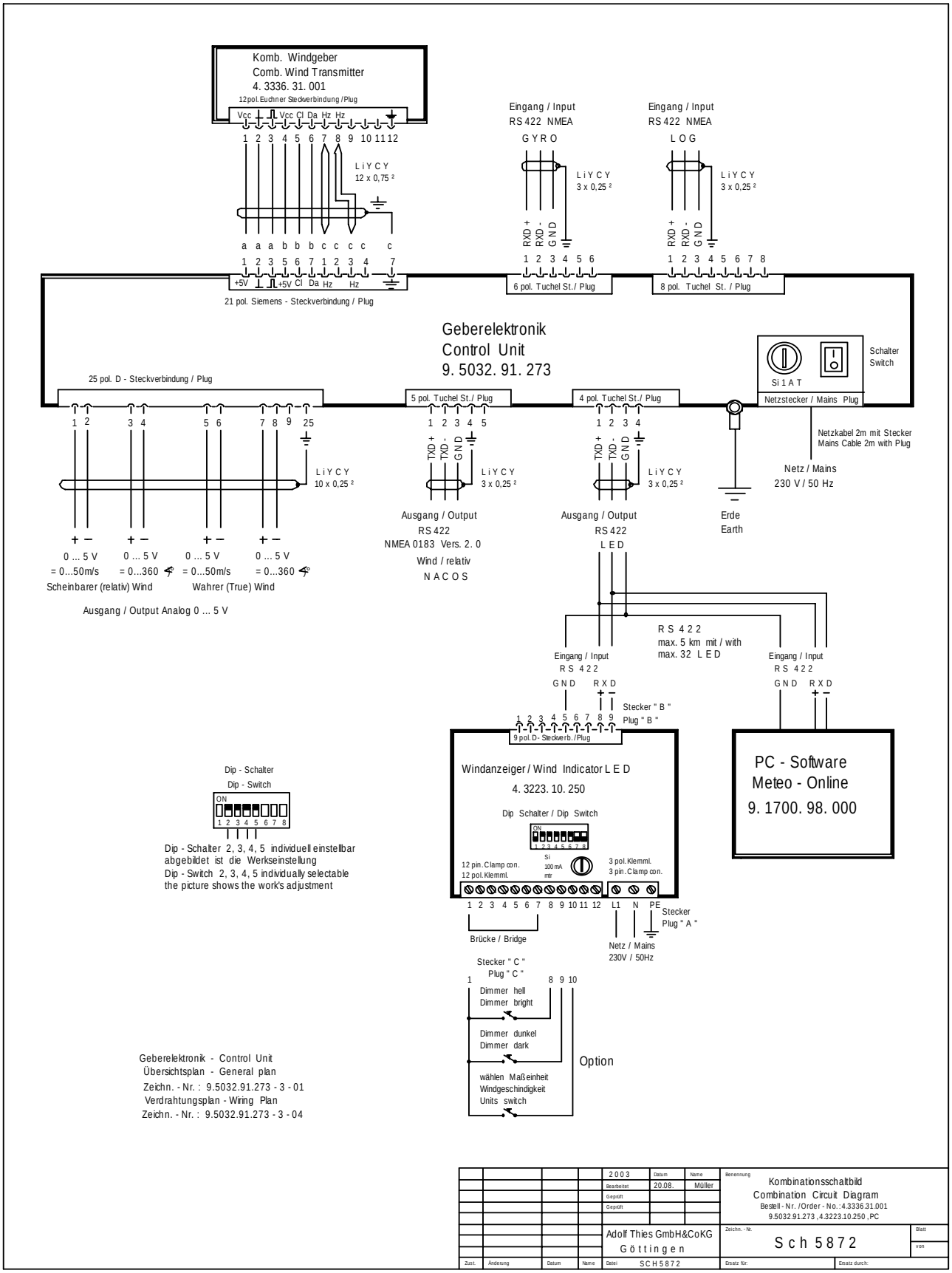
Drawing 1

Combination Circuit Diagram for Control Unit 9.5032.92.201



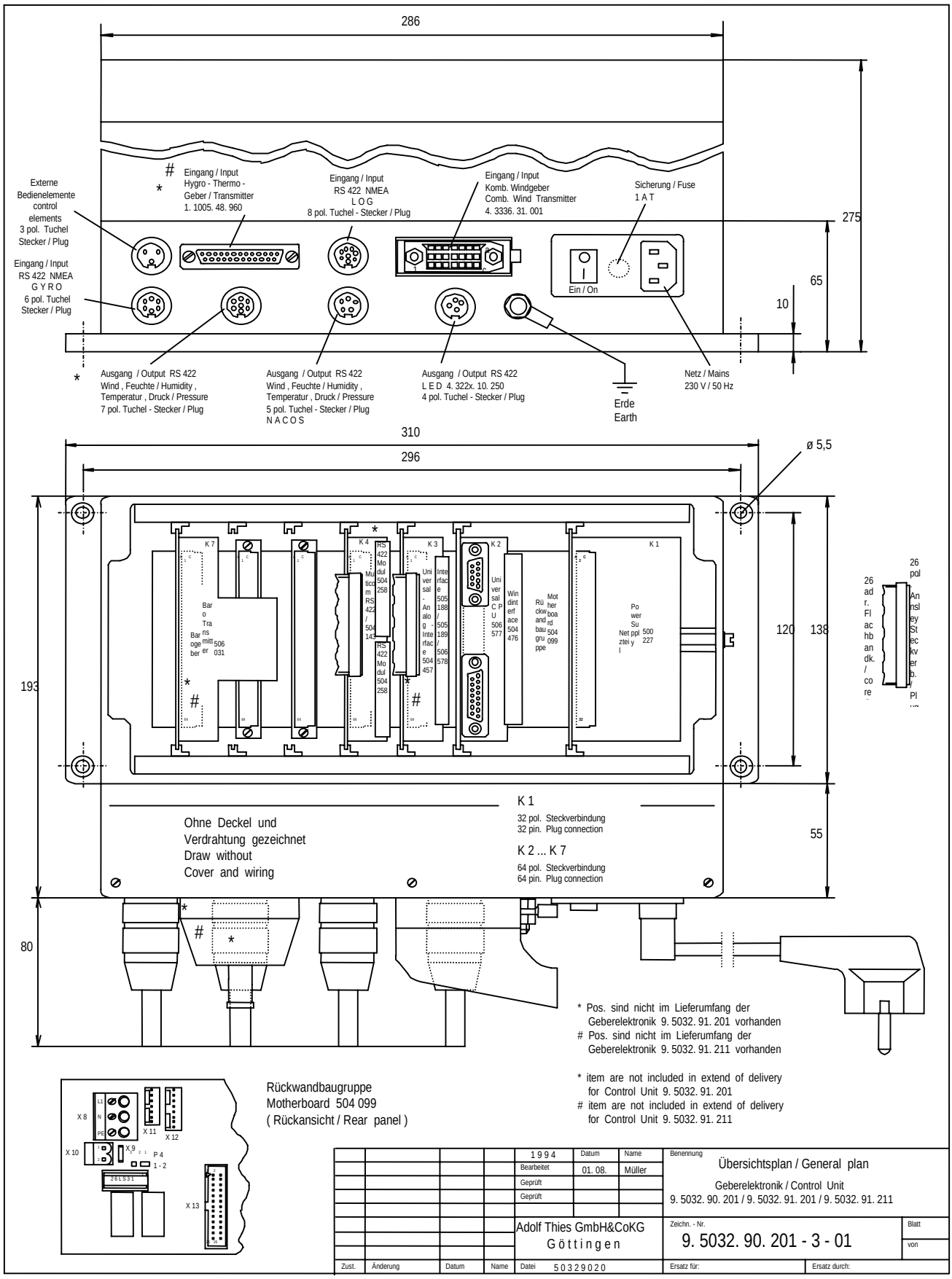
Drawing 2

Combination Circuit Diagram for Control Unit 9.5032.91.273



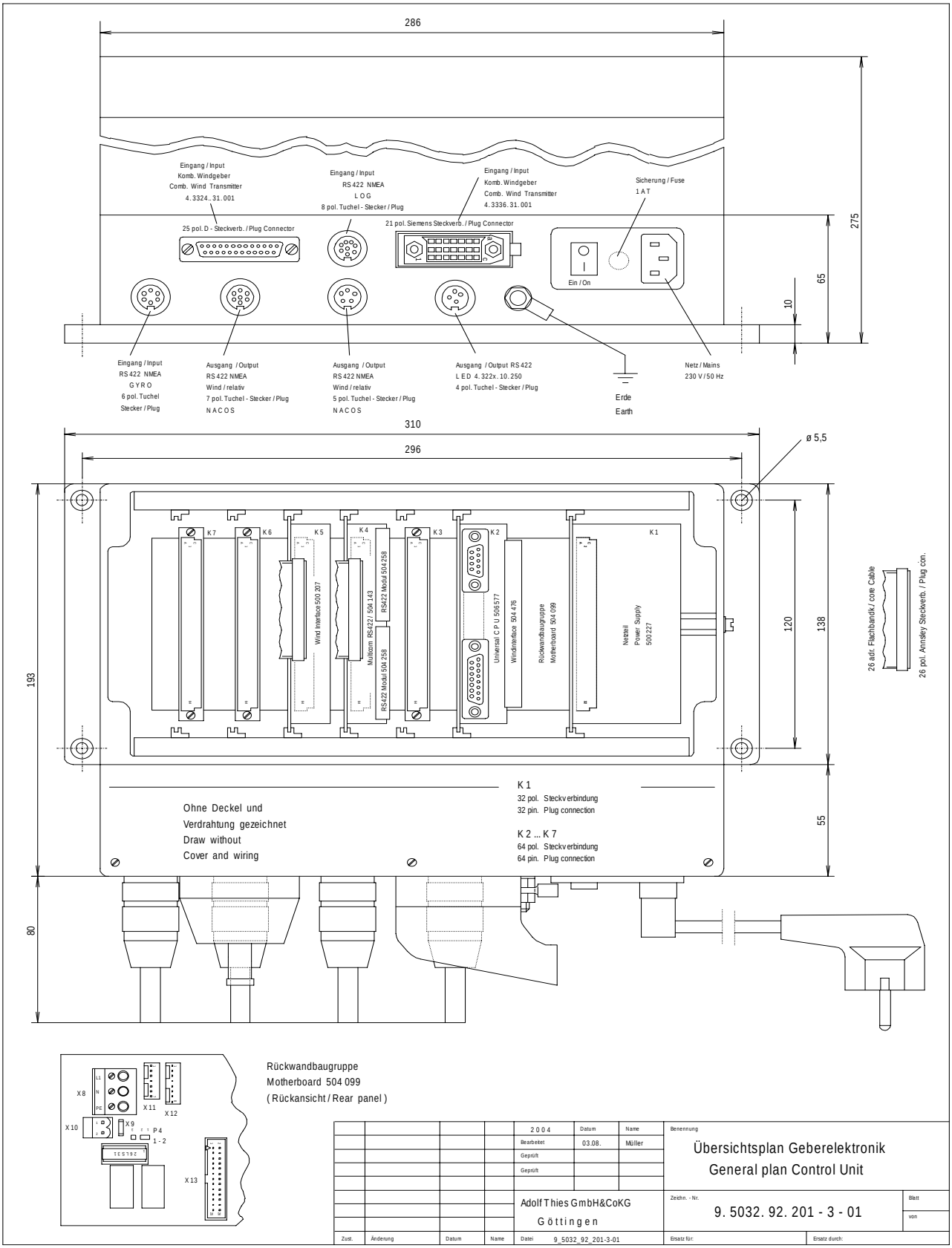
Drawing 3

General Plan for Control Units 9.5032.91.201, 9.5032.90.201, 9.5032.91.211



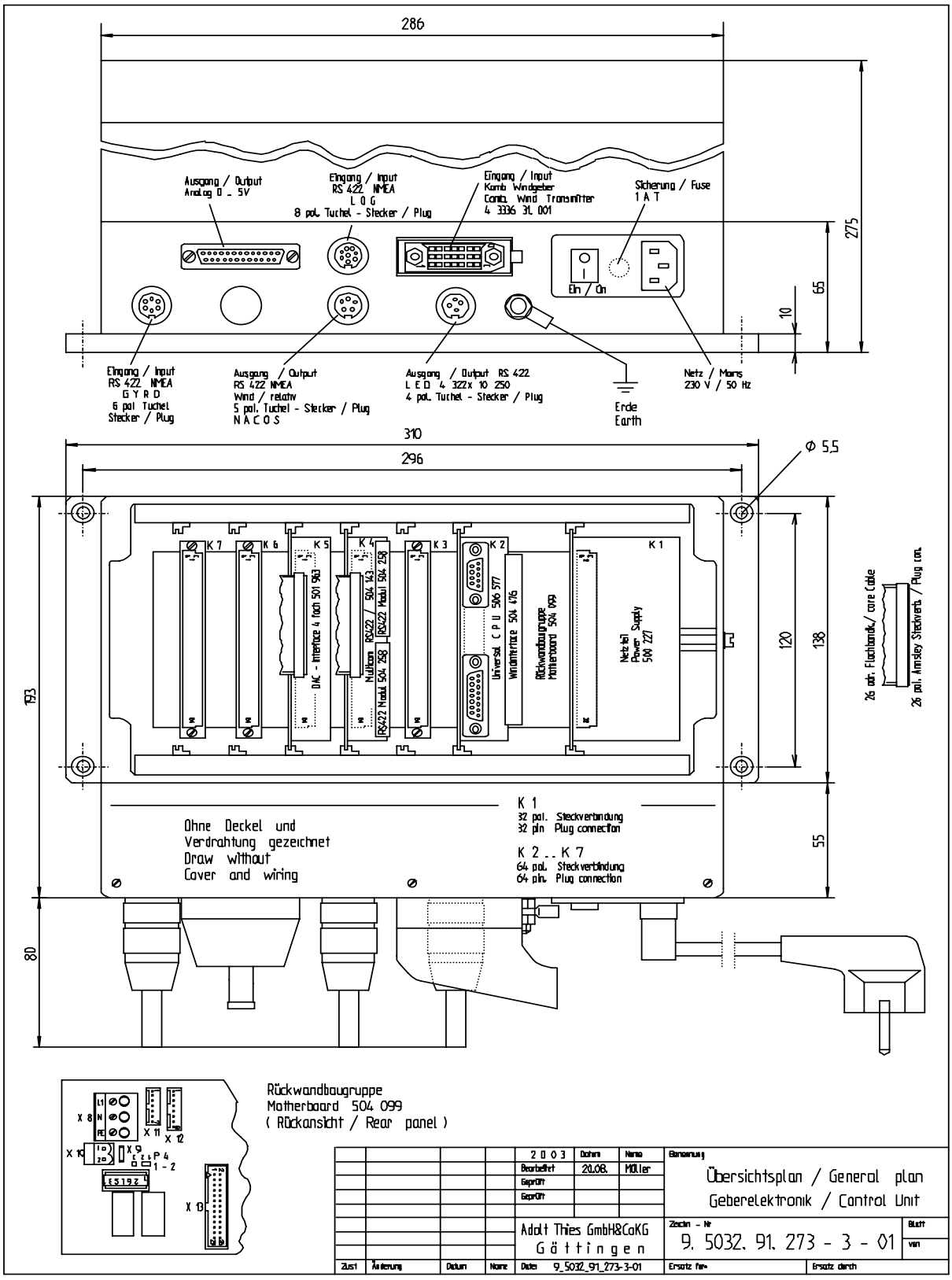
Drawing 4

General Plan for Control Unit 9.5032.92.201



Drawing 5

General Plan for Control Unit 9.5032.91.273



Drawing 6

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