Technical description

airleader MASTER and *airleader* CN

- **Optimizes automatically**
- **Self-learning**
- **Easy installation**
- **Easy to use**

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Compressor Management

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Application area — AIRLEADER MASTER module and CN

10% of industrial electricity demand

is used in Europe to produce compressed air - and the demand is increasing. An EU study commissioned by the Fraunhofer Institute found that energy costs alone **are up to 30% higher than necessary.**

Compressed air is expensive

therefore, in more than 30 years of planning and selling compressor stations, the wishes of compressed air users for efficient compressed air generation have been compiled and implemented in the current AIR-LEADER MASTER module.

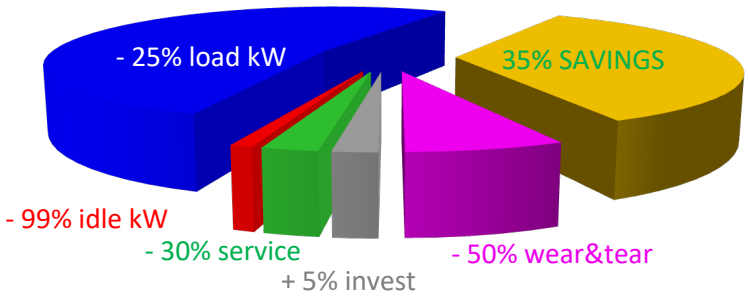
The AIRLEADER has been

the effective answer for the energy-conscious compressed air user - who applies the lever in the right place to prevent unnecessary costs from arising in the first place.

The AIRLEADER MASTER module

reduces all running costs demonstrably and in some cases dramatically:

- Fewer compressor operating hours
- Less load and idle kWh
- Reduced spare parts costs
- Reduced service costs



The integrated monitoring

records the control sequence to the second and provides a transparent image of the compressed air station. The standard web-based visualization allows access to all data via ETHERNET connection. The view of the clearly prepared tables and diagrams is done via Internet Explorer from all computers with access authorization. This is what makes detailed **cost control** of compressed air generation possible in the first place.

Higher-level BMS systems

are also provided with real-time information by the AIRLEADER MASTER module. For this purpose, Modbus and OPC servers, XML-RPC, SOAP web services or the exchange of digital and analog signals directly at the controller are available.

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Functions AIRLEADER MASTER Module and CN

1. AIRLEADER automatically optimizes up to 16 (MASTER) or 32 (CN) compressors

and adapts to changes as it learns itself. Through iterative computing processes, the AIRLEADER MASTER module permanently and automatically determines the grid dynamics, the network volume and other parameters. **Time-consuming adjustment, retraction, adjustment, etc. is completely eliminated!**

2. The MASTER module is easy to use

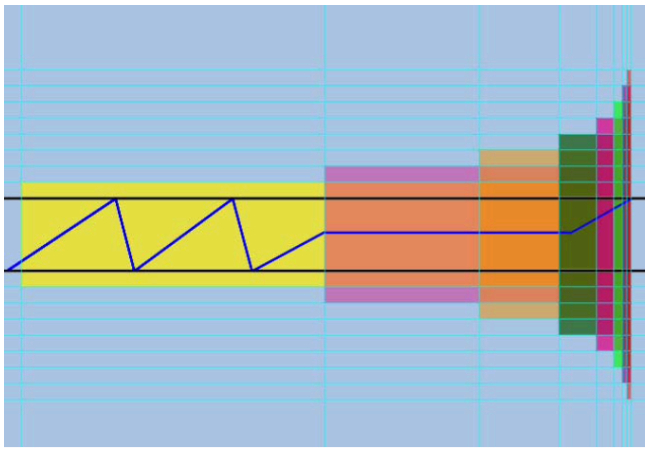
All you have to do is enter the compressor delivery quantities and the desired pressure belt. Done — the AIRLEADER module takes care of everything else for you.

3. AIRLEADER combines different compressors

into a unit that automatically adjusts to production according to current compressed air consumption. It ensures that only the most efficient compressor combination produces the compressed air needed for production, **regardless of manufacturer** and performance. The compressor combination works with sensible hysteresis calculation, with minimal load-idle switching cycles and thus the lowest idle times. Instead of idling the large compressors, the right combination runs under load, with the smallest compressor clocking.

4. The mains pressure remains within the lowest limits

care is taken to ensure that the costs incurred remain as low as possible. Thanks to the possibility of connecting **several pressure sensors** , further away operating parts can be monitored and integrated into the control pressure. If a running compressor malfunctions within the pressure belt or is switched off for maintenance, its performance is replaced by other compressors.



5. The 8-fold self-learning calculation depth

ensures that the compressors are dynamically adapted to the compressed air consumption. In time windows of different lengths, the compressed air consumption and dynamics are continuously calculated and evaluated. If necessary, the **correct compressor combination is always switched.** Unnecessary switching cycles are prevented.

6. Compressor runtime compensation

Compressors with the same power output receive the same high operating hours, taking into account the engine running times. Once a specified time offset has been reached, the compressors are replaced **without any pressure drop** within the pressure belt.

7. Manual rankings

Manually specified priorities allow the compressors to work at different ranks. This feature is often used for compressors with heat recovery (preferred priority) or reserve compressors (low priority). Compressors of the same rank automatically work according to consumption.

8. Control pressure averaging

From any number of pressure sensors (max. 64), 2 more can be defined as control pressure sensors in addition to the reference pressure sensor directly on the controller. If the pressure on a sensor drops, the averaged control pressure also decreases accordingly, and the control system reacts earlier. As a result, the entire compressed air generation system works more sensitively and the pressure can be lowered accordingly, because every tenth of a bar saves about 1% of energy!

9. 32 GB data storage as standard

Sufficient for a storage capacity of approx. over 20 years with a second-by-second recording of all compressor and sensor states in the AIRLEADER module itself. These can be read out at any time using laptops and are carried in parallel and, if necessary, synchronized when web visualization is connected.

10. Compressed air quality monitoring and incident handling

In the smallest configuration stage, **up to** 20 analogue sensors **can be connected to the Airleader as standard** via connection modules for monitoring compressed air quality (pressure, dew point), cooling water (pressure, temperatures), room temperatures or compressed air balances (flow sensors). Each analog input has a switching output that is activated when the limit value is exceeded.

Up to **24 or 72 additional digital inputs** for fault or operating messages are recorded, monitored and visualized simultaneously. This allows the proper operation of ancillary units such as dryers, steam traps, ventilation, cooling water pumps, etc. to be fully verified.

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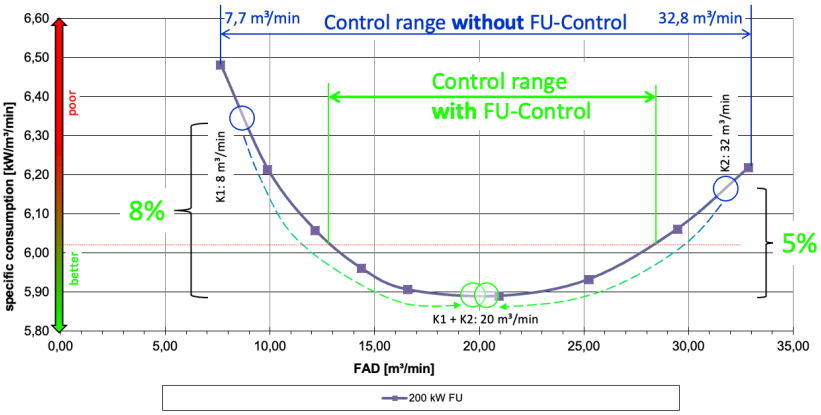
Functions — AIRLEADER MASTER Module and CN

11. Decentralized compressors control via LAN/network/Ethernet

As an alternative to the hardwired bus connection, all components can be connected via TCP/IP network. Especially with decentralised compressors, cable pulling is significantly reduced! The configuration is very easy to integrate into the programming interface of the Airleader:

12. NEW: FU-Control - actively integrate any number of FU/VSD compressors

If several FU compressors are in use at the same time, a new algorithm monitors every 5 seconds whether the compressors are running in the "green" range (factory set to 20 - 80% of the control range, but changeable). If not, the pressure specification (actual pressure at the AO of the connection module) is dynamically changed in order to influence the compressors in their speed so that they run as optimally as possible. This means that all compressors can be operated reliably without interfering with the compressor's internal controller or frequency converter. This saves again significantly due to the efficiency gain!



13. NEW: FIX-Speed if possible:

By default, the Airleader prefers the FU systems, which is usually desired, but often not particularly energy efficient. Unregulated compressors have fewer internal losses and should be used as soon as possible. This function ensures this as soon as it is activated. If an existing FIX-Speed compressor fits into the control range of the FU compressor(s), it is not the 2nd, 3rd or 4th FU that is used, but a suitable and usually more economical (since full load) FIX-Speed compressor.

Data — AIRLEADER MASTER module and CN

Up to 16 / 32 compressors

- Only one RS-485 connection module is inserted into each compressor.
- Wiring is easy via the RS-485 bus cable from compressor to compressor.
- The RS-485 interface is galvanically isolated to avoid interference.
- AIRLEADER power supply: 24 V DC, connection modules: 18-30 volts AC/DC.

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Data AIRLEADER MASTER module and CN

Additional 8 / 32 Connection modules for accessories

for sensors with 4-20 mA output allow the connection of up to 16 / 64 analog signals for:

- Pressure Dew Point Sensors
- Room Temperature Sensors
- Pressure Sensors
- Flow-Sensors
- Current measurement
- Energy Measurement

and up to 24 / 72 digital signals such as fault messages from dryers and auxiliary equipment. In the case of passive sensors, the 24 V DC power supply is provided by the connection module.

Airleader housing in fully shielded design with metal cover

- standard in a plastic or metal housing with IP54 protection.
- Electrical connection of the components from below via industrial multiple plugs.
- Powered by a 90-250 VAC wide-range power supply.
- Opt.: Installation kit, suitable for installation in existing control cabinets.
- Opt.: Metal control cabinet, 500 x 500 x 200 mm, connections on terminal block, space reserve.

Compressor status is displayed on the main page of the 10" MASTER touchscreen

with different icons, including:

- -LOAD, IDLE, FAULT, READY, COMMUNICATION DISRUPTED, MANUAL

Other reports include:

- Compressed air consumption in m³/min
- Current mains pressure in bar
- And 5 other sensors, e.g.:
  pressure dew point in °C
  Energy measurement in kWh
  compressor room temperature
- Current print profile
- Current ranking
- Timer state
- Programming release Status
- Collective fault message accessories

From here, the intuitively usable programming levels and statistics pages are branched out.

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Data AIRLEADER MASTER module and CN

Parameterization

is easily done via the 10" touchscreen directly on the MASTER module or via WLAN and web interface. The menu navigation is done in plain text, is logically structured and self-explanatory. The menu language can be changed to 8 different languages. Unauthorized data modification is prevented by a key switch.

As standard, programming by the operator can also be done password-protected via Internet Explorer directly on the screen of the CN version or on the operator's computer on the desktop. Factory support is usually not necessary!

Real-time weekly timer

with up to 16 switching points for the following time-controlled functions:

- ON/OFF compressor station.
- **4 different print profiles**.
- **4 different rankings** with different compressor priorities.
- ON/OFF of 2 relay contacts (for auxiliary devices like dryers or valves).

4 x key switches (on digital inputs on the controller module)

1. **Compressors START/STOP** switches the station on and off
2. **Compressors Manual/Automatic** switches compressors to "on-site" operation
3. **CLOCK ON/OFF** activates the weekly timer
4. **Progr.**(emmier release) **ON/OFF** protects / allows data entry (Image: MASTER Version)

6 x digital inputs on the controller module

for external selection of 3 additional pressure profiles and 3 additional precedence sequences via switch contact as an alternative or in addition to the timer, whereby the digital input has priority over timer.

8 x digital outputs on the controller module

Dig. Out 1: Minimum pressure (AI 1) / Device malfunction.
Dig. Out 2-4: Exceeding limit values analog sensor (AI 2 – 4)
Dig. Out 5: Compressors fault
Dig. Out 6: accessories collection disorder (dryer, filter, condensate, ...).
Dig. Out 7, 8: 2 x timer outputs for switching auxiliary equipment.

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Data AIRLEADER MASTER module and CN

4 x Analogeingänge (4-20 mA)

AI 1: Pressure transmitter connector (supplied as standard) for control pressure.

AI 2 - 4: Analog sensor connection (optional or stock).

2 x Analogausgänge (4-20 mA)

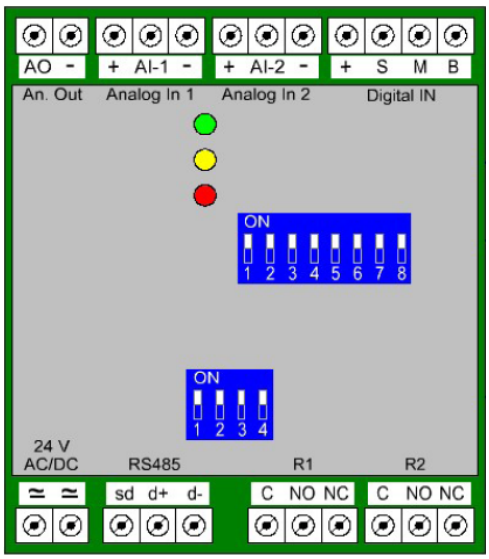
AO 1: Control pressure above the range specified by the pressure transmitter, e.g. 0-16 bar.

AO 2: Compressed air consumption in m^3/min (100% = sum of all programmed compressors)

Data RS 485 connection module

RS-485 Connection module for compressors:

(DIP switch addressing 1-16):



The bus interface to the compressor

d+ /d-: Serial RS 485 bus connection

S: Digital input "Compressor fault"

M: Digital input "Compressor motor running"

B: Digital input "Compressor operational"

R1: Relay "Remote/local" circuit" (changeover contact)

R2: Relay "load/no-load" (changeover contact)

AI 1: Analog input (4-20 mA) for
- "Amperé measurement" (1-phase),
- "kW measurement" (3-phase) or
- "Inverter signal"

AI 2: Analog Input (4-20 mA) "Temp. Measurement" for compressor oil temperature

AO: Analog Output (4-20 mA) "Pressure" ACTUAL Pressure for VSD Compressors (FU Control)

RS-485 Connection Module for Accessories

(same hardware, DIP switch addressing 17 - 24):

d+ /d-: Serial RS 485 bus connection

S, M, B: 3 x digital inputs - for fault or operation reporting of external devices

AI 1 - 2: 2 x analog inputs (4-20mA) - for temp, dew point, pressure, flow sensors etc.

R 1 - 2: 2 x Potential-free relays - Alarm contact in case of exceeding limit values of the sensors on analog inputs AI 1- 2, alternatively timer contacts R1 and R2

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Technical data + scope of delivery — MASTER module and CN

Scope of delivery	MASTER	CN
1. Number of connectable RS485 connection modules	24	64
1. - of which for compressors (max.)	16	32
2. - of which for accessories and ancillary units	8	32
3. Key switch for main functions (ON, Manual, Timer, Lock)	4	
4. Analogeingänge (4-20 mA) für Sensoren (Series / max.)	4 / 52	132
5. Analogausgänge (4-20 mA) (Series / max.)	2 / 26	34
6. Digital inputs for external control	10	
7. Digital outputs for fault messages, etc. (series / max.)	8 / 24	of 72
8. Capacity of the internal memory (32 GB series)	>20 years	
9. Common pressure difference for all compressors	standard	
10. Control of the compressors according to compressed air consumption	standard	
11. Multiple Control Pressure Transmitters for Large Nets	standard	
12. Data entry via plain text menu	standard	
13. Code Backup	standard	
14. 10“ Touchscreen	standard	
15. Number of Menu Languages	8	
16. Online visualization (web-based) via MS Internet Explorer®	standard	
17. EXCEL® and WORD® Export Function for Reports and Tables	standard	
18. Remote control and programming via PC	standard	
19. Number of speed controlled compressors	16	32
20. Connection of a room temperature sensor to the Master Module	standard	
21. Pressure Transmitter Delivery	standard	
22. Multifunction Weekly Timer	standard	
23. Supplied in plastic housing for wall mounting	standard	
24. Energy and compressed air balancing with automatic reporting	standard	
25. Service Management (Bra-Dependent Service Status)	standard	
26. Connection of a dew point sensor to the Master Module	standard	
27. Manual Compressor Ranking Adjustment	standard	
28. Remote ON/OFF	standard	
29. Summer/winter time changeover automatically via web server	standard	
30. Supplied in a metal control cabinet for wall mounting	option MS	strd
31. Supplied with front frame for control cabinet installation	option S	-

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Technical data + scope of delivery — MASTER module and CN

Technical data		MASTER and CN
INTERFACES:		
1. RS 485 bus interface for connection modules		2
2. Interface RS 485 for PC, Modbus RTU, etc		1
3. RS 485 interface for special functions		1
4. ETHERNET interface with RJ45 socket		1
5. Instantaneous consumption [m³/min]	Analog output 4 - 20 mA	1
6. Mains pressure [bar]	Analog output 4 - 20 mA	1
7. Collection fault compressors	switching output 24V DC	1
8. Minimum pressure and device fault	switching output 24V DC	1
9. Collecting fault accessory	switching output 24V DC	1
10. Limit Alarm Sensors	Switching Output 24V DC	3
11. Timer Contacts Switching	Output 24VDC	2
POWER SUPPLY:		
Mains voltage		90 – 250 V AC
APPLICATION:		
Compressor capacity		0 – 200 m³/min
Pressure range		0 - 16 bar
Minimum pressure difference		0.3 bar
Pressure Options:		
• Low pressure	0 – 1 bar	option "1 bar"
• Low pressure	0 – 2.5 bar	Option "2.5 bar"
• High pressure	0 – 50 bar	Option "50 bar"
• High pressure	0 – 400 bar	Option "400 bar"
• Vacuum	0 – 1.000 Bar	Option "Vacuum"

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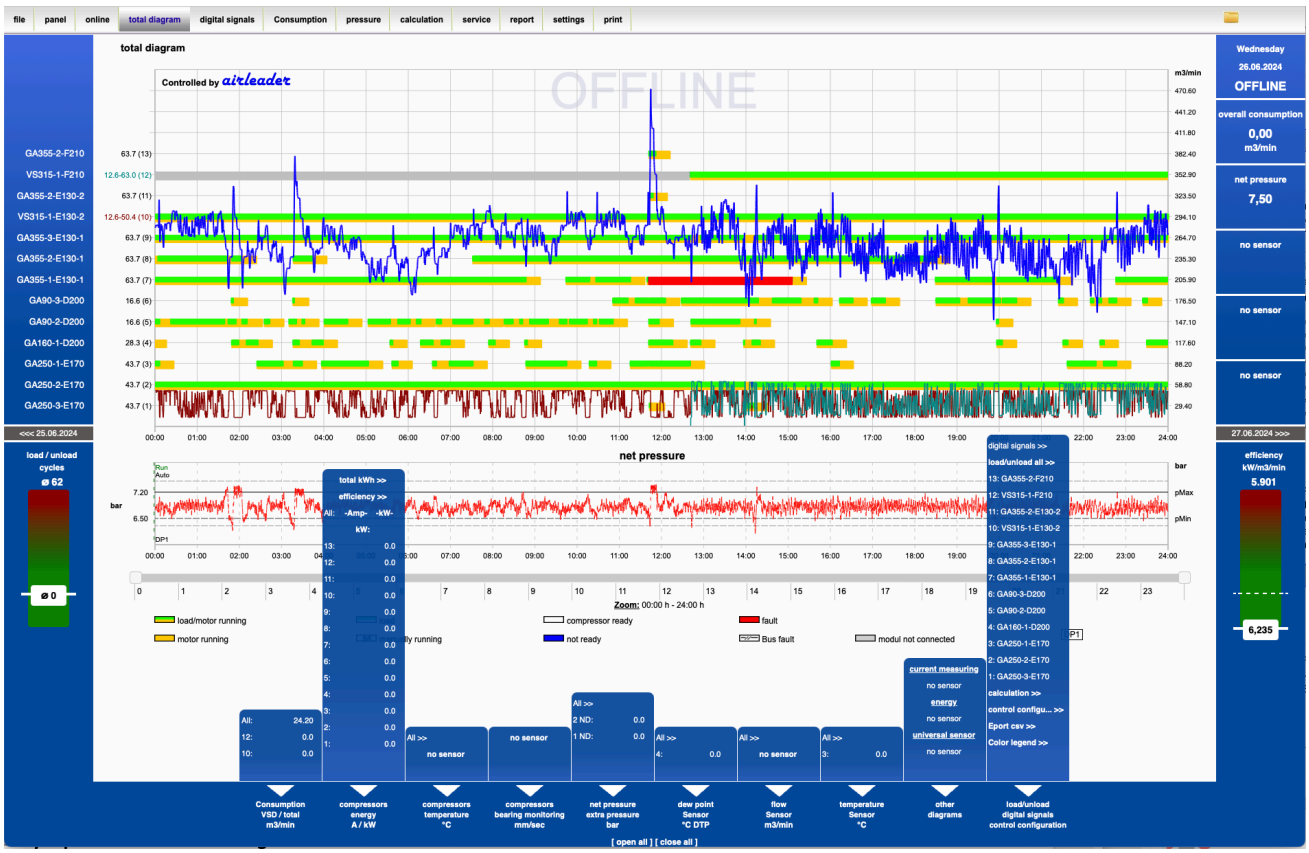
Visualization AIRLEADER MASTER module and CN

Online visualization web-based

The online visualization runs as a background service on a server and allows access to the AIRLEADER MASTER module from any PC in the network via **Internet Explorer** and the IP address. It does not matter how many participants access the AIRLEADER at the same time - the visualization does not slow down. The data is stored in a server directory and is then also subject to internal data backup. A defect on the memory card of the MASTER module does not result in irretrievable data loss. On the other hand, missing data due to connection interruptions, e.g. during server maintenance, after connection is established, is automatically synchronized again by the data stored in the MASTER module.

All important information at a glance:



Always up to date - the online diagram:

Colored status bars:

- Green = load requirement.
- Yellow = engine / empty
- Red = Fault
- Blue = Not Ready
- Grey = Bus Fault

Current values:

- DL consumption curve
- FU/VSD compressor curve
- Pressure curve
- All sensor values (also as a graph)

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Visualization AIRLEADER MASTER module and CN

High data density

The data is stored **every second**. The memory card (32 GByte) included as standard in the MASTER module is able to back up **data for over 20 years** with 16 connected compressors . The standard web-based visualization displays the control sequence to the second by means of a zoom function - or provides a 24-hour overview. And that goes back to the time of commissioning.

Energy and compressed air balancing

A report generation periodically and **automatically** creates a

- Daily balance
- Weekly balance
- Monthly balance

with all energy relevant compressed air parameters. Clearly compiled for each compressor and summed up for the entire station.

In addition to the energy and runtime data, the number of engines starts, and the number of load-idle circuits are also recorded, which with the AIRLEADER MASTER module usually only account for a service-saving small fraction compared to before.

COMPRESSOR DATA AND ENERGY CALCULATION — **Samstag 01.08.2020 - Mittwoch 26.08.2020**

efficiency:	7,61481 kW/(m3/min)	€/kWh:	0,15 €/kWh	load costs:	99,92 %
efficiency:	0,12691 kWh/m3	P-min:	7,2 bar	unload cost:	0,08 %
costs:	0,01904 €/m3	P-max:	7,8 bar	total costs:	9.457,58 €

channel	compressor	m3/min		load kW		kW	load		unload		average %	cycles		compressed air	total kWh			efficiency kWh/m3	total costs €		
		min	max	min	max	unload	h	min	h	min	load	motor	load	m3	load	unload	total		load	unload	total
01	CompAir L55-10		8,6		100,00	30,00	33	26	0	23	98,9	15	15	17.252	2.285,8	10,4	2.296,2	0,13310	342,87	1,57	344,43
02	ALUP SCK 75		10,0		0,00	0,00	308	1	0	8	100,0	17	17	184.810	22.206,0	4,8	22.210,9	0,12018	3.330,90	0,73	3.331,63
03	Rallye 101		8,6		0,00	0,00	57	25	1	9	98,0	46	46	29.627	3.471,5	23,8	3.495,3	0,11798	520,72	3,57	524,29
04	Rallye 101		8,6		0,00	0,00	30	16	0	24	98,7	16	16	15.618	1.839,7	8,3	1.848,0	0,11833	275,96	1,24	277,20
05	AC GA 90 VSD	2,2	17,5	0,00	0,00	0,00	551	56	0	0	100,0	1	1	249.493	33.200,2	0,0	33.200,2	0,13307	4.980,03	0,00	4.980,03
											sum total	95	95	496.799	63.003,2	47,4	63.050,6	0,12691	9.450,48	7,10	9.457,58

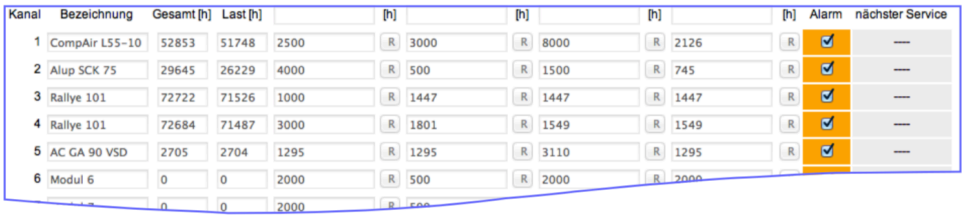
The table can be exported to MS Office at the click of a mouse.

Airleader records real measured energy values, either ex works (see accessories kW/A measurement) or via MODBUS if measuring devices are already installed. This is the only way for the data to be ISO 50.001 compliant.

Predictive maintenance becomes easier

The operating hours of each compressor are counted separately according to total and load hours and displayed in the service mask.

After programming (or RESET after maintenance), the entered times count backwards to 0. If a time has elapsed, this maintenance message is entered in the monthly ALARM and SERVICE REPORT at the exact time.



Kanal	Bezeichnung	Gesamt [h]	Last [h]		[h]		[h]		[h]	Alarm	nächster Service
1	CompAir L55-10	52853	51748	2500	R	3000	R	8000	R 2126	R	☑	---
2	Alup SCK 75	29645	26229	4000	R	500	R	1500	R 745	R	☑	---
3	Rallye 101	72722	71526	1000	R	1447	R	1447	R 1447	R	☑	---
4	Rallye 101	72684	71487	3000	R	1801	R	1549	R 1549	R	☑	---
5	AC GA 90 VSD	2705	2704	1295	R	1295	R	3110	R 1295	R	☑	---
6	Modul 6	0	0	2000	R	500	R	2000	R 2000			
		0	0	2000	R	500						

The Time counts into minus and turns red. A service warning will also appear on the screen. The interval time can be reset individually to the previously set interval using the "R" buttons (reset button).

Up to 4 service positions with different service intervals can be determined for each compressor (e.g. filter mats 500 h, air filter 1,000 h, oil and oil filter 2,000 h, oil separator 4,000 h).

With the "**Alarm + Service Management**" option, you will be automatically notified by e-mail, SMS or fax.

Alarm + Service-Management

On compressor or auxiliary device malfunctions, this message is transferred to the monthly Alarm + Service report and appears on the screen as an alarm warning.

Accumulating fault messages are detected at an early stage. The clear monthly report in table display helps:

Airleader Kompressor-Management Alarm + Service-Report

2021-01			Alarmmeldung			Servicemeldung	
Pos	Datum	Uhrzeit	Kompressor Modul	Steuerung	Analogmodule	Kompressor Modul	Änderungsmeldung
560	18.01.2021	12:33:32	-	-	Lagerüberwachung CM02 S "Alup SCK 75"	-	-
559	18.01.2021	12:18:46	-	-	Lagerüberwachung CM02 S "Alup SCK 75"	-	-
558	18.01.2021	12:06:45	-	-	Lagerüberwachung CM02 S "Alup SCK 75"	-	-
557	18.01.2021	11:54:44	-	-	Lagerüberwachung CM02 S "Alup SCK 75"	-	-

Data interfaces and export

Airleader is a completely **open system** and makes all measured or determined data available via various independent platforms **for higher-level systems (e.g. for BMS/ZLT or energy management systems).** This can be done via software or hardware interfaces and in various formats. **Measurement data from external sensors** can also be integrated via hardwiring, bus interfaces or via network.

The Airleader has a **USB interface** for data export, among other things. This can be used to save data archives on a USB stick - even if visualization is not available. This data is used for offline visualization of the station on any computer, e.g. to analyze the running behavior or to carry out simulations with the measurement and simulation software.

Firmware updates and add-ons are also installed via this interface.

An image that contains text, sign. Auto-generated description**MS Office (Excel/Word)** exportieren, um damit sofort für Dokumentationen zur Verfügung zu stehen.

The **CSV export** button can be used to create a corresponding daily file, which can then be further edited, e.g. via Excel. The daily data contains all recordings and evaluations of the air-leader at 10-second intervals and is archived compressed in one file per day.

An image that contains text, clip art. Auto-generated description**Modbus-Server** alle relevanten Daten der Druckluftstation in einer genormten Protokollbeschreibung über eine Softwareschnittstelle zur Verfügung. Über die **Modbus Datenintegration** können Sensordaten per **Modbus RTU** oder **Modbus TCP** eingelesen werden.

The internal OPC server makes the process data available as OPC objects to the second, regardless of the Airleader. The OPC client accesses the data provided by the OPC server and displays it graphically in the control station (BMS).

- JSON + XML
- Plain XML
- SOAP
- AJAX

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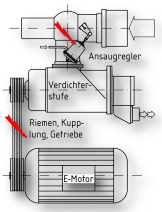
airleader

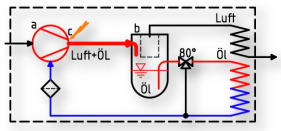
Important accessories AIRLEADER MASTER module and CN

kW / A-Measurement



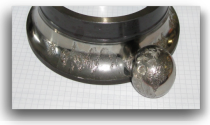
- For the Energy Report gem. ISO 50,001
- Defect monitoring intake regulator + drive
- Monitoring load running / idling / standstill

Oil and coolant temperature measurement



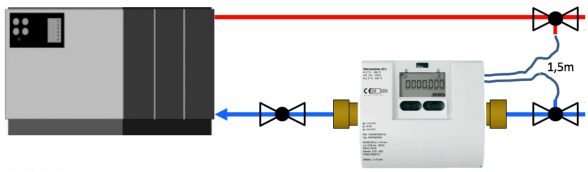
- Detect overtemperatures in real time
- Avoid wear and tear
- Increasing operational reliability

Prevent bearing damage



- Avoid expensive air end damages
- Early detection of bearing damage
- Easy installation

Heat meters for heat recovery



- For Heat recovery
- See if you save
- See what you save

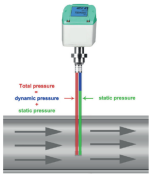
Filter monitoring online

- Filters destroy energy
- Changing in time saves money
- Changing according to demand saves money

Prevent wet compressed air

- Detect dryer faults in good time
- Ensuring compressed air quality
- Documenting compressed air quality

Balancing compressed air



- Assign consumption to cost centers
- Efficiency measurement on compressed air
- Measure machine consumption

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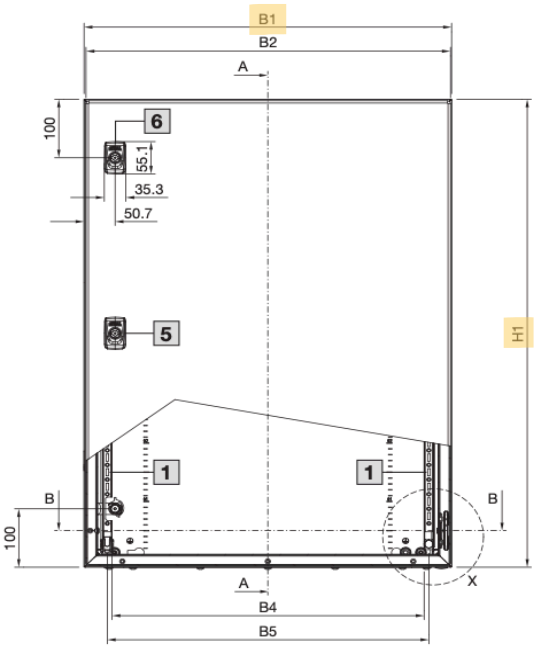
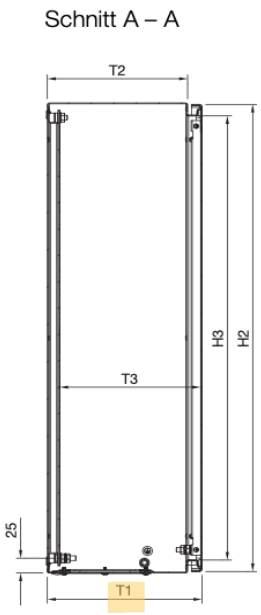
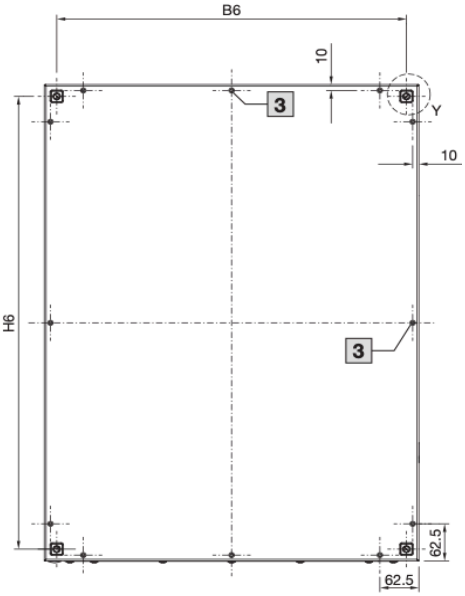
Control cabinet dimensions — AIRLEADER MASTER module

Metal control cabinet

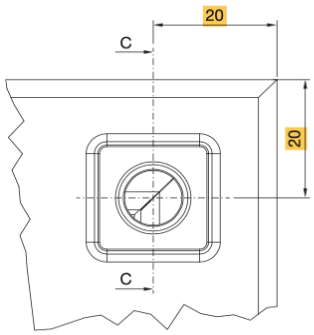




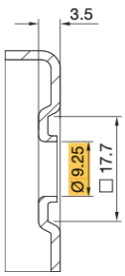


Best.-Nr. AX	Breitenmaße mm							Höhenmaße mm						Tiefenmaße mm			
	B1	B2	B3	B4	B5	B6	B7	H1	H2	H3	H4	H6	N	T1	T2	T3	T7
1050.000	500	494	452,7	409,5	425	460	411	500	494	456,5	350	460	14	209,7	187,0	188,5	113

Einzelheit Y



Schnitt C – C



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Control cabinet dimensions — AIRLEADER MASTER module

Plastic control cabinet

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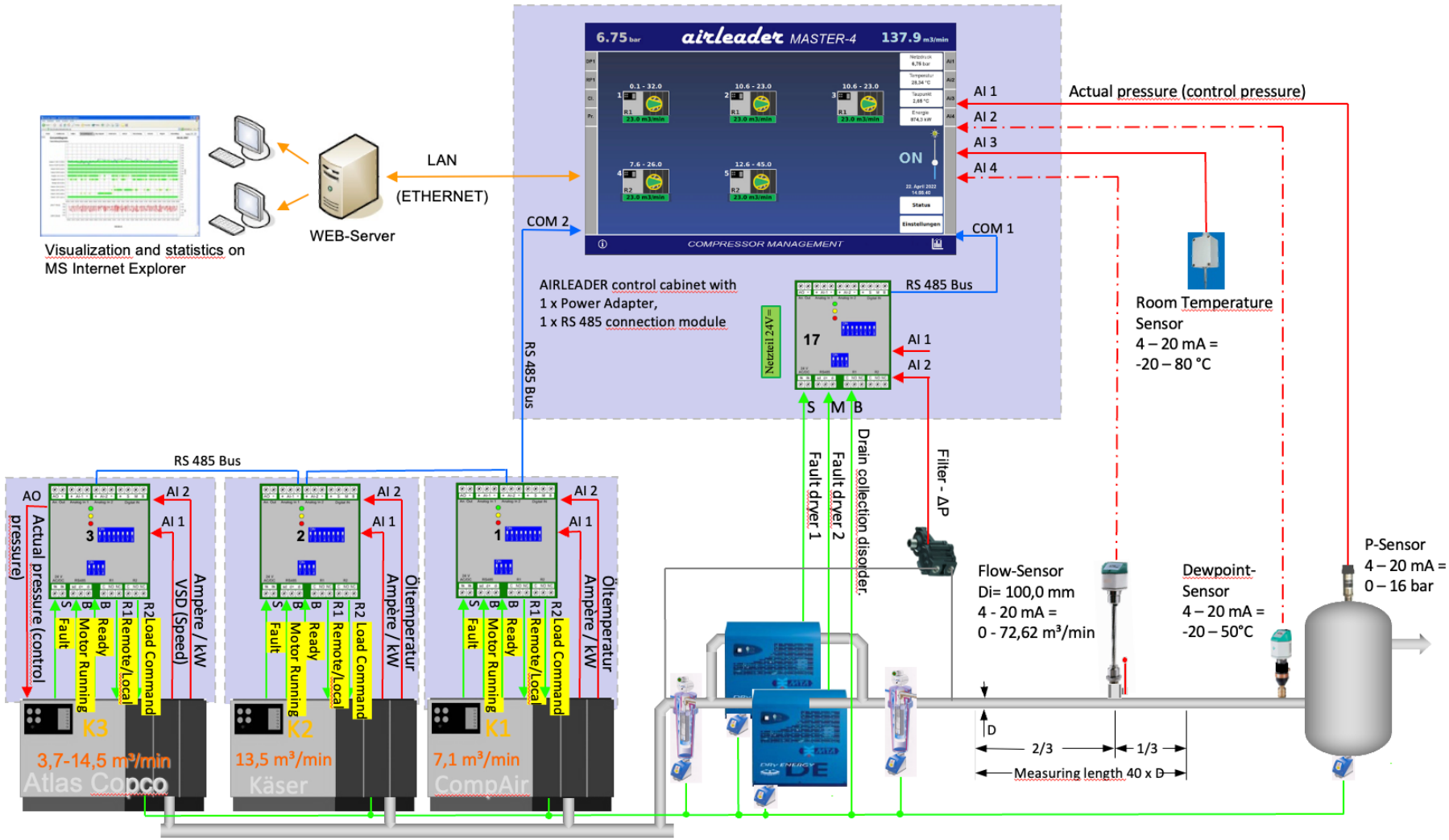
6.75 bar
airleader MASTER-4
137.9 m3/min
COMPRESSOR MANAGEMENT
ON
LAN
(ETHERNET)
WEB-Server
Visualization and statistics on
MS Internet Explorer
COM 2
COM 1
RS 485 Bus
AIRLEADER control cabinet with
1 x Power Adapter,
1 x RS 485 connection module
Netzteil 24V=
17
AI 1
AI 2
AI 3
AI 4
Actual pressure (control pressure)
Room Temperature
Sensor
4 – 20 mA =
-20 – 80 °C
S M B
Fault dryer 1
Fault dryer 2
Drain collection disorder.
Filter - ΔP
RS 485 Bus
AO
Actual pressure (control pressure)
Fault
Motor Running
Ready
R1 Remote/Local
R2 Load Command
Ampère / kW
VSD (Speed)
Öltemperatur
K3
3,7-14,5 m³/min
Atlas Copco
K2
13,5 m³/min
Käser
K1
7,1 m³/min
CompAir
Flow-Sensor
Di= 100,0 mm
4 - 20 mA =
0 - 72,62 m³/min
Dewpoint-
Sensor
4 – 20 mA =
-20 – 50°C
P-Sensor
4 – 20 mA =
0 – 16 bar
D
2/3
1/3
Measuring length 40 x D

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Some of our happy customers: