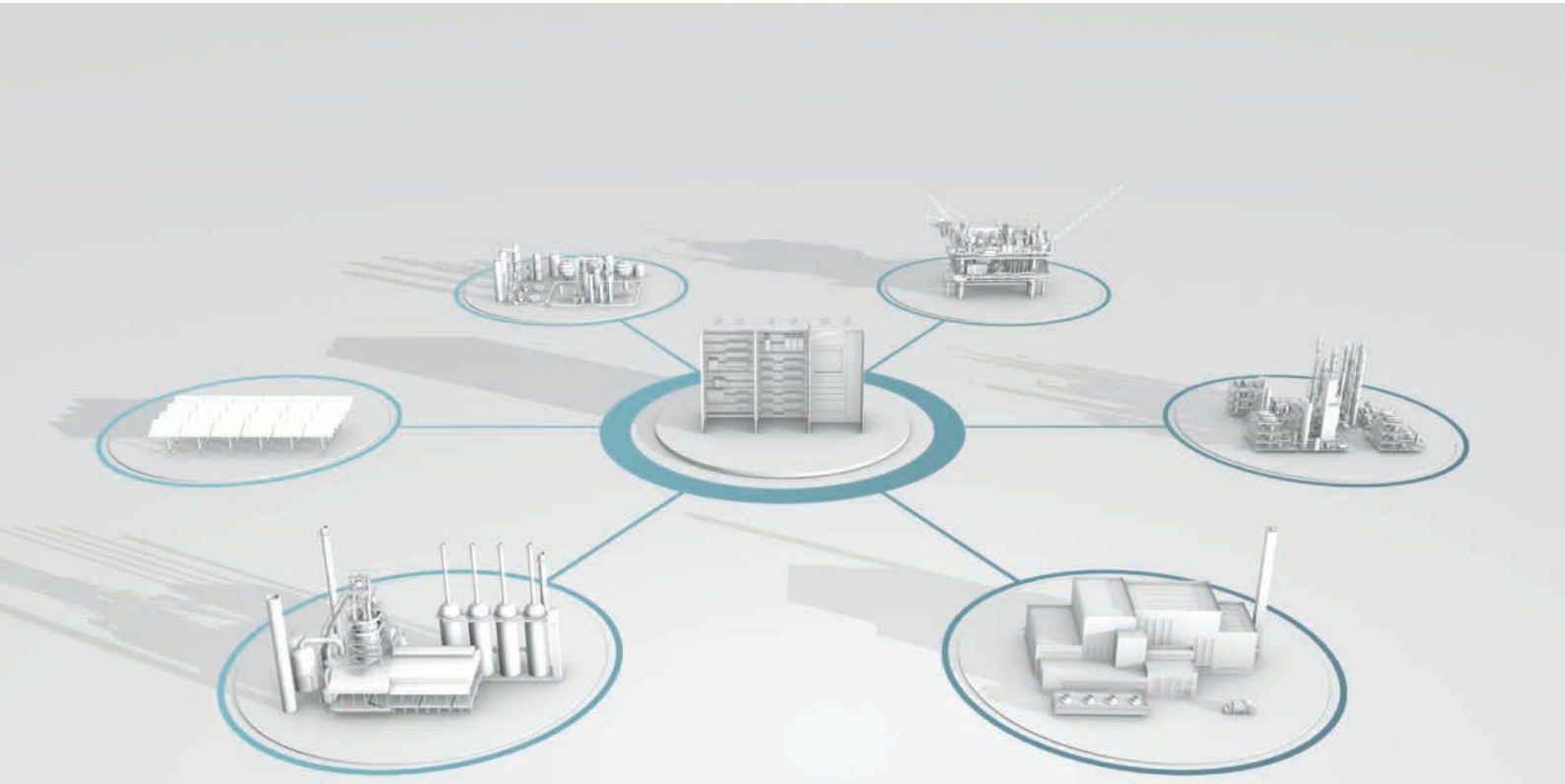
MAN Energy Solutions
Future in the making

Turbo-machinery automation

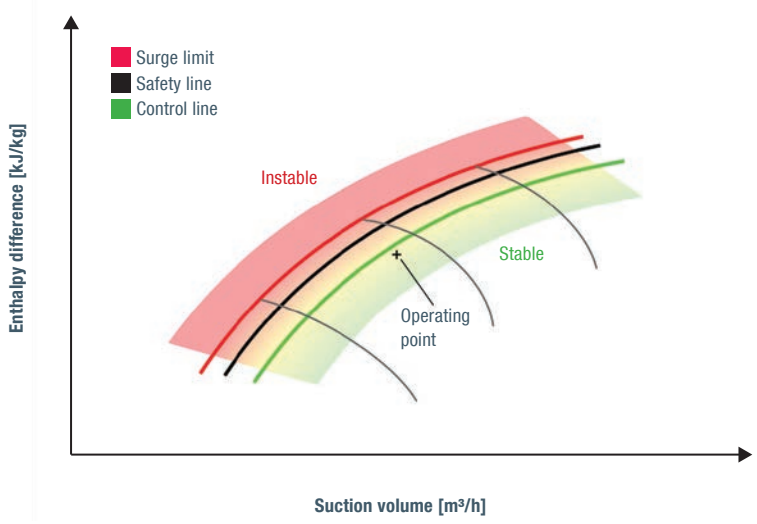


Anti Surge Control for all axial and centrifugal compressors

control systems
turbomachinery

Anti surge background

In turbomachinery trains the Anti Surge Controller is the key factor for reliable and safe compressor operation. MAN Energy Solutions offers Anti Surge Control solutions for a wide range of compressor applications for generations.



Typical compressor control map

Purpose of control

The purpose of Anti Surge Control is to offer a wide operating range and at the same time minimize the risk of damage to the compressor.

The surge limit divides the performance map into a stable and an unstable range. Surges occur in the unstable range. These are events where the delivery medium flows back periodically from the pressure side to the suction side, thereby causing alternating stress on the compressor. To prevent this surging behaviour compressors are equipped with anti surge control valves (blow-off or recycle valves). The control line in parallel to the surge line ensures that the intervention of the Anti Surge Control logic is initiated before the actual surge area is reached.

The distance between the operating point and the surge control line is continuously calculated. By controlled opening of the anti surge valve(s) the compressor flowrate can be increased, such that the operating point will remain within the stable operating range.

The following measurements are relevant for Anti Surge Control:

- Flow measurement for compressor map calculation
- Discharge pressure measurement for compressor map calculation and pressure limitation
- Suction pressure measurement for compressor map calculation, if applicable
- Suction and / or discharge temperature measurement for compressor map / control line compensation, if applicable

Anti surge control features

MAN Energy Solutions has a history of 110 years in turbomachinery control design and has obtained more than 20 patents for Anti Surge Control methods.

Anti Surge Control features

Control behavior adapted to process specific requirements by OEM

Based on MANs long term experience with various process applications, the Anti Surge Controller behavior is especially adapted in coordination with the thermodynamic calculation department under consideration of process specific requirements.

Control line adaption

In order to ensure the most effective compressor control map at all times, the Anti Surge Control line may be calculated depending on variable input parameters, such as inlet temperature, speed and inlet guide vane position.

Dynamic control features

The Anti Surge Controller offers thought-out features for dynamic controller intervention.
Depending on the velocity of the current operating point movement, the Anti Surge Controller may intervene before the static control line is reached.

Add-ons

Perfect interaction with MAN process and performance controllers

The interfaces of the Anti Surge Controller are optimized to interact as plug & play solutions with MAN process and performance controllers like the multifunctional turbine controller (ST-MfC) and the load sharing controller (LOSHCO).

Anti Surge Protection concept

The MAN Anti Surge Protection is rounded off by the Surge Detection System which may be either integrated in the PLC package along with the Anti Surge Control or be provided as a stand-alone solution.

The control algorithm includes the following specialized functions:

- New: interpolation between up to 4 control lines for a maximum operational range
- New: expandable with up to 4 limit control loops
- New: seemless interaction with choke line control
- New: dynamic intervention feature based on velocity of operational point
- New: fouling supervision for intercooled compressors
- Fallback strategies in case of instrument failure
- Decoupled control algorithms
- Asymmetric controller output (enables a slow closing and a fast opening of the control valve)
- Anti wind-up
- Manual valve positioning mode
- Automatic load/unload sequence

Anti surge control narrative

Unit control panel for turbomachinery control

History

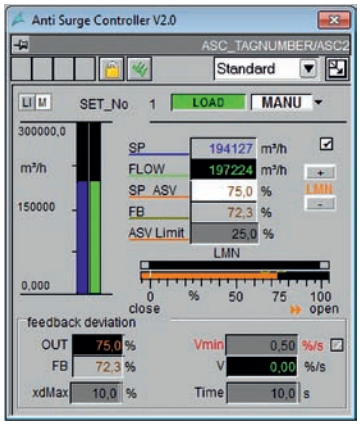
The Anti Surge Controller by MAN is based on more than 110 years of experience in turbomachinery control systems.
For the centerpiece of compressor controls the first patent was granted in 1960. As a pioneer in the Anti Surge Control developments, MAN introduced major control features in the 1970s for increased dynamic control quality.
The MAN Anti Surge Controller has been continuously optimized based on the experience with over 1,000 compressors running worldwide.
MAN Energy Solutions is part of the API working group for Anti Surge Control and Anti Surge Protection and offers API compliant solutions.

References

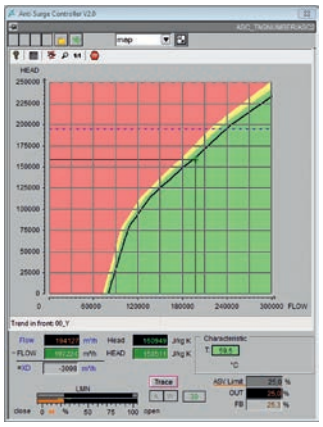
The Anti Surge Controller by MAN Energy Solutions has been successfully implemented in various applications with well-known customers, such as
- Honeywell UOP
- SHELL
- EXXON

Control and operator platform

Operator-friendly HMI design features



HMI view for Anti Surge Controller



Real time plotting of compressor data in HMI

System integration

The Anti Surge Controller by MAN Energy Solutions may be integrated in a complete PLC package by use of a dedicated task for machinery unit control or it can be provided as a dedicated control application.
For the optional integration in a customer automation system, the following hardware and software requirements have to be met:
– milliseconds, 20 ms preferred
– Fast analog input module, basic execution time of the module < 20 milliseconds

Operation

The Anti Surge Controller can be remote-operated via a hard-wired or serial software interface. The process visualization by MAN offers well-structured multilevel control and operating options.

The following screens are included in the Anti Surge Controller standard faceplate:

Standard view
In the standard view the process status can be observed, all relevant measurements are displayed.

Map view
The map view shows the project specific compressor map with head as a function of the flow and the current operating point.

Alarm view
The alarm view indicates the alarm messages related to the Anti Surge Controller.

Trend view
The trend view shows online and historic trends of the process variables and setpoints.

Parameter view
The controller parameters may be checked and adjusted.

Control line view
The control line parameters are displayed.

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