

## 53 **stfl – STEAM FLOW COMPENSATION FUNCTION BLOCK**

### 53.1 **USE**

Mass flow of steam is measured indirectly by measuring the differential pressure acting across an orifice plate. The measurement requires compensation because it is affected by the temperature and pressure existing at the measurement time, and the result is not linear relative to the differential pressure.

In case of a measuring transmitter with square root extraction, it is necessary to define the squared scale of the measured value for the measurement channel (compare with cwsqrt's square root feature).

### 53.2 **FUNCTIONAL DESCRIPTION**

#### 53.2.1 **Operation**

Compensation occurs in accordance with the following formula:

$$f = f_{scale} * \sqrt{\frac{dp}{dp_{scale}} * \frac{r}{rq}}, \text{ where}$$

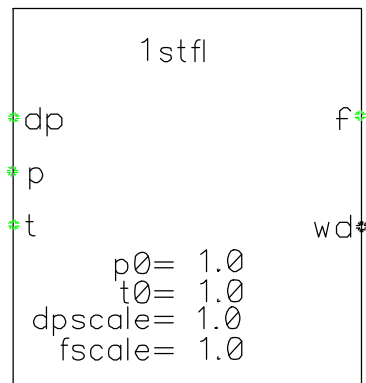
f           = compensated measured flow  
 fscale     = scaling factor for f  
 dp         = differential pressure across orifice plate  
 dpscale   = differential pressure scaling  
 r           = steam density at operating point  
 rq         = steam density at design point

The rq constant is determined by stfl on the basis of the design point pressure and temperature by accessing the corresponding density value from steam table.

Compensated flow at the design point has the value fscale when the value of differential pressure is dpscale.

Density r at each operating point is derived from steam table when the existing temperature and pressure are known.

### 53.2.2 Symbolic representation





## ADMINISTRATION\_PART

```

NAME:      pr:40-F-419.F
TYPE:      function
STATUS:    incomplete
CREATOR:    dna
    CREATED:      2001-12-12 15:23:00
MODIFIER:    dna
    MODIFIED:     2001-12-12 15:30:14
DESTINATION: AP01
EXECUTION:   1000
    ORDINAL:      20
DESCRIPTION: "stfl "

```

## REPRESENTATION\_PART

## EXTERNALS

```

    pr:40-F-406:av  TYPE ana TRANSFER 192,10,0,0 "PK4 STEAM PRES-
SURE" ;
    pr:40-T-405:av  TYPE ana TRANSFER 192,10,0,0 "PK4 STEAM TEMPE-
RETURE" ;
    pr:40-F-419.I:m TYPE ana TRANSFER 192,10,0,0 ;

```

## DIRECT\_ACCESS

```

    BLOCK pr:40-F-419 ;

```

## INTERFACE

```

    MODSTAT TYPE ktstat < ( 1,1,0 ) ;

```

## FUNCTIONAL\_PART

```

1stfl
p0= ( 392.0 )
t0= ( 170.0 )
dpscale= ( 15.0 )
fscale= ( 8.30 )
dp< pr:40-F-419.I:m
p< pr:40-F-406:av
t< pr:40-T-405:av
f> -
wd> -
;

```

```

2am IS pr:40-F-419
hyst= ( 1 )
un= -
av< 1stfl:f
hh< ( 400.0 )
h< ( 400.0 )
l< ( 0.0 )
ll< ( 0.0 )
out> -
hha> -
ha> -
la> -
lla> -
fa> -
;

```

```

END

```

### 53.3 DATA STRUCTURE

#### 53.3.1 Configuration parameters

##### **p0**

**Type:** float  
**Default:** 1.0  
**Description:** Absolute pressure at design point [kPa]

##### **t0**

**Type:** float  
**Default:** 1.0  
**Description:** Temperature at design point [°C]

##### **dpscale**

**Type:** float  
**Default:** 1.0  
**Description:** Differential pressure scale at design point, i.e.,  $0 \leq dp \leq dpscale$

##### **fscale**

**Type:** float  
**Default:** 1.0  
**Description:** Output scale at design point, i.e.,  $0 \leq f \leq fscale$

#### 53.3.2 Connection parameters

##### **Inputs**

##### **dp**

**Type:** ana  
**Default:** 16 0.0  
**Description:** Differential pressure across orifice plate

Unit is not significant, since the value of dp is scaled by means of dpscale.

##### **p**

**Type:** ana  
**Default:** 16 0.0  
**Description:** Steam pressure, [kPa], excess pressure

##### **t**

**Type:** ana  
**Default:** 16 0.0  
**Description:** Steam temperature [°C]

## Outputs

### f

**Type:** ana  
**Default:** 48 0.0  
**Description:** Compensated steam flow

Unit is not significant, since f is scaled with fscale. Fault bit der is set when one of the inputs is faulty. Fault bits inv and old are set when one of the outputs is outside permissible limits.

### wd

**Type:** bin  
**Default:** 48  
**Description:** Watchdog (operating point outside table)

When wd = ON, the values of stfl cannot be considered reliable.

If wd = ON and f gives the value 0.0, the design point was outside the stfl operating range.