MANCHESTER 1824
The University of Manchester

CPI - STRA DATA FILE FORMAT

General Information

All current data files follow a common style, which is designed to allow easy inclusion of new data items.

Basic principles

Case insensitive
Order insensitive
Column insensitive
Any missing data supplied by program (sensible defaults)

Data is stored in the form of:

Item_name = value, value, value, …

The data items are delimited by commas (“,”)
The line will be ignored if the data items are missing or not the correct type (real, character etc.)
All values must be on the same line as the “Item-name”

Character data – spaces & special characters. Preceding and following spaces are ignored by the system i.e.

Process_name = 1, primary distillation tower , summer operation

Would return the values
1
“primary distillation tower”
“summer operation”

Some characters have special meaning to the system so they cannot be used directly in character data. Any special characters are converted into an equivalent token

To use ;	Type	
“,” (comma)	= “~ “ (space)	Delimiter
“;”	= “~#”	Inline comment … value, value ; this is a comment
“!”	= “~@”	Entire line is commented !item_name = value , value
“~”	= “~~”	Token identifier

The data file has an identifier header and two sections delimited by the two keywords [COUNTERS] & [DATA]

Identifier header

This must be the first line in the file i.e

2.0 [UMIST SDF Data File Version Number 02/11/1998 10:34:00]

2.0 = data file version number
[UMIST SDF Data File Version Number 02/11/1998 10:34:00] = optional information (ignored by program)

[COUNTERS]

This must precede the [DATA] section.

This gives summary information as to the size of the problem contained within the file.

It is used to check that the program can accommodate the problem and used to initialise the default data areas.

Any “item_name” which should be in the [DATA] section will be ignored

[DATA]

This must follow the [COUNTERS] section. Any “item_name” which should be in the [COUNTERS] section will be ignored.

This is the main information form the program. As data items are read in they overwrite any default information.

Miscellaneous items

The data file may contain information that is ignored by the system

[### ….] = these are treated as comment and are ignored
“ “ Blank lines
“!” This is a comment line
“;” Inline comment … value, value ; this is a comment
[EOF] End of File marker – ignored by program

STAR "item_names"

Counters section

No_Strms = N

Total number of process streams

No_Segs = N

Total number of stream segments. If the properties of the stream vary with temperature this may be represented as a set of piecewise linear segments.

No_UtyStrms = N

Total number of utility streams

No_UtySegs = N

Total number of utility segments. If the properties of the utility vary with temperature this may be represented as a set of piecewise linear segments. Maximum 3 per utility

No_StrmConst = N

Toatl number of stream design constraints – not used

Data section

Stream data

Strm_TS <stream_no>, <segment_no>, <temperature [C]>

Stream supply temperature

<stream_no> (1-No_Strms) this is used to specify to which stream the segment belongs
<segment_no> (1-No_Segs) this is used to specify the ordinal position of the segment i.e.

Strm_TS = 1, 1, 159.000
Strm_TS = 2, 2, 267.000
Strm_TS = 3, 3, 332.000
Strm_TS = 3, 4, 91.0000
Strm_TS = 4, 5, 25.0000
Strm_TS = 5, 6, 118.000

Segment 3 & 4 belong to stream 3

Default = 1.0

Strm_TT <stream_no>, <segment_no>, <temperature [C]>

Stream target temperature. Must be at least 0.01 [C] difference from supply temperature
<segment_no> (1-No_Segs) this is used to specify the ordinal position of the segment
<stream_no> is ignored
Default = 0.0

Strm_CP <stream_no>, <segment_no>, <Specific heat [Kw]>

Stream specific heat capacity (including mass flowrate)
<segment_no> (1-No_Segs) this is used to specify the ordinal position of the segment
<Stream_no> is ignored
Default = 0.0

Strm_HTC <stream_no>, <segment_no>, <Film heat transfer coefficient [Kw/c.m^2]>

Stream film heat transfer coefficient.
<segment_no> (1-No_Segs) this is used to specify the ordinal position of the segment
<Stream_no> is ignored
Default = 2.0

Strm_GTF <stream_no>, <segment_no>, <flag>

Stream approach temperature contribution flag
<segment_no> (1-No_segs) this is used to specify the ordinal position of the segment
<Stream_no> is ignored
<Flag> = 0 segment uses global DTmin value
<Flag> = 1 segment uses Strm_GT value
Default = 0

Strm_GT <stream_no>, <segment_no>, <temperature [C]>

Stream approach temperature contribution value
<segment_no> (1-No_segs) this is used to specify the ordinal position of the segment
<Stream_no> is ignored
See also Strm_GTF
Default = 0.0

Strm_Name <stream_no>, <name c*12>

<stream_no> number of stream (1- No_Strms)
Stream name – maxiumum 12 characters
Default = '<unnamed>'

Utility data

UtyStrm_TS <utility_no>, <segment_no>, <temperature [C]>

Utility supply temperature
<utility_no> (1-No_UtyStrms) this is used to specify to which utility the segment belongs
<segment_no> (1-No_UtySegs) this is used to specify the ordinal position of the segment i.e.

UtyStrm_TS = 1, 1, 159.000
UtyStrm_TS = 2, 2, 267.000
UtyStrm_TS = 3, 3, 332.000
UtyStrm_TS = 3, 4, 91.0000
UtyStrm_TS = 4, 5, 25.0000
UtyStrm_TS = 5, 6, 118.000

Segments 3 & 4 belong to utility 3
Default = 1.0

UtyStrm_TT <utility_no>, <segment_no>, <temperature [C]>

Utility target temperature. Must be at least 0.01 [C] difference from supply temperature
<segment_no> (1-No_UtySegs) this is used to specify the ordinal position of the segment
<utility_no> is ignored
Default = 0.0

UtyStrm_CPR <utility_no>, <segment_no>, <CP ratio>

Utility Cp ratio
<segment_no> (1-No_UtySegs) this is used to specify the ordinal position of the segment
<Utility_no> is ignored
Default = 0.0

UtyStrm_HTC <utility_no>, <segment_no>, <Film heat transfer coefficient [Kw/c.m^2]>

Utility film heat transfer coefficient.
<segment_no> (1-No_UtySegs) this is used to specify the ordinal position of the segment
<Utility_no> is ignored
Default = 2.0

UtyStrm_GTF <utility_no>, <segment_no>, <flag>

Utility approach temperature contribution flag
<segment_no> (1-No_UtySegs) this is used to specify the ordinal position of the segment
<Utility_no> is ignored
<Flag> = 0 segment uses global DTmin value
<Flag> = 1 segment uses UtyStrm_GT value
Default = 0

UtyStrm_GT <utility_no>, <segment_no>, <temperature [C]>

Utility approach temperature contribution value
<segment_no> (1-No_UtySegs) this is used to specify the ordinal position of the segment
<Utility_no> is ignored
See also UtyStrm_GTF
Default = 0.0

UtyStrm_Name <utility_no>, <name c*12>

<utility_no> number of utility (1- No_UtyStrms)
Utility name – maxiumum 12 characters
Default = '<unnamed>'

UtyStrm_ON_F <utility_no>, <flag>

Utility on/off flag
<utility_no> number of utility (1- No_UtyStrms)
<Flag> = 0 utility is off
<Flag> = 1 utility is on
Default = 1

UtyStrm_Cost <utility_no>, <annual cost [£/(kw.yr)]>

Utility annual cost per unit load
<utility_no> number of utility (1- No_UtyStrms)
Default = 0.0

UtyStrm_link <utility_no>, <linked utility_no>, <ratio >

Different utility can be linked to form complex utility systems e.g. a flue gas (hot utility) can be linked to an air preheat (cold utility) thus ensuring that the flowrate through the two maintain the same ratio.

<utility_no> number of utility (1- No_UtyStrms)

<linked utility_no> number of linked utility (0- No_UtyStrms). If value is 0 the utility is not linked to another utility
<ratio > CP1 = <ratio>*CP2

UtyStrm_Min_Load <utility_no>, <flag>, <value [Kw] >

Minimum permitted load on utility
<utility_no> number of utility (1- No_UtyStrms)
<flag> 0 = limit ignored
<flag> 1 = limit applied
<value> minimum load on utility
Default = flag = 0, value = 0

UtyStrm_Max_Load <utility_no>, <flag>, <value [Kw] >

Maximum permitted load on utility
<utility_no> number of utility (1- No_UtyStrms)
<flag> 0 = limit ignored
<flag> 1 = limit applied
<value> maximum load on utility
Default = flag = 0, value = 0

UtyStrm_Exist_Load <utility_no>, <value [Kw] >

Existing load on utility for retrofit saving calculations
<utility_no> number of utility (1- No_UtyStrms)
<value> Existing load on utility
Default = 0.0

Uty_CapCst <utility_no>, <coefficient A >, <coefficient B >, <coefficient C>

Capital investment cost of utility (not utility heat exchanger costs)
<utility_no> number of utility (1- No_UtyStrms)
£ = A + B (total utility load [kw])^C
Default A,B & C = 0

UtyStrm_Emiss_Term = <utility_no>, <term >, <value>

Utility emission information
<utility_no> number of utility (1-No_UtyStrms+1), if <utility_no> = No_UtyStrms+1 this refers to the central power generation
<term>
<value>

Economic data

HX_Cap_Cost = <cost law no>, <coefficient A >, <coefficient B >, <coefficient C>

Capital investment cost of heat exchanger
<cost law no> number of cost (must be 1)
£ = A + B (Exchanger load [kw])^C
Default A,B & C = 0

ECON_Economic_Method <value>

Capital annualisation method
<value> (must be 1)

ECON_Plant_life <value [Yr]>

Capital investment annualisation period
<value> years
Default = 1

ECON_Rate_of_Interest <value [%]>

Capital investment interest rate
<value> loan % charge
Default = 0.0

ECON_Operating_Hours <value [hr]>

Plant annual operating time
<value> annual operation hours
Default = 8600

Existing_Area <value [M^2]>

Existing heat exchanger area for retrofit investment calculations
<value> existing exchanger area
Default = 0.0

Miscellaneous data

Proj_Description <CRLF flag>, <description c*60>

User specified description of file
< CRLF flag > 1 add carriage return line feed code to end of text description

<description > text description

Spec_Recovery <value>

Specified how the energy recovery is specified during targeting
<Value> = 1 = Dtmin, 2 = Hot utility, 3 =Cold Utility
Default = 1

Spec_DTmin <value [C]>

Specified minimum approach temperature
<value> = Dtmin
Default = 10.0
See also Recovery_Spec

Spec_HotUty <Value [KW]>

Specified hot utility consumption for targeting
<value> = Hot utility consumption
Default = 0.0
See also Recovery_Spec

Spec_ColdUty <Value [KW]>

Specified cold utility consumption for targeting
<value> = Cold utility consumption
Default = 0.0
See also Recovery_Spec

X12_Shells <value>

Parameter used to estimate the number of 1-2 shells during exchanger calculations
<value> a value of 0.9 will give a Ftmin value of about 0.75, as the value is increased Ftmin decreases
Default = 0.9

Shell_Max_Area <value [M^2]>

Maximum area per heat exchanger shell
<value>
Default = 1e30

Ambient_Temperature <value [C]>

Ambient temperature for exergy calculations

<Value>
Default = 25 [C]

Exergetic_Eff <value>

Exergetic efficiency
<Value> (0-1)
Default = 0.700000

Simple example file

2.0 [UMIST SDF Data File Version Number 02/11/1998 10:34:00]

[COUNTERS]
No_Strms = 5
No_Segs = 6

[DATA]
[### Stream Data]
Strm_TS = 1, 1, 159.000
Strm_TT = 1, 1, 77.0000
Strm_CP = 1, 1, 2.28500
Strm_HTC = 1, 1, 0.100000
Strm_GTF = 1, 1, 0
Strm_GT = 1, 1, 7.50000

Strm_TS = 2, 2, 267.000
Strm_TT = 2, 2, 80.0000
Strm_CP = 2, 2, 0.204000
Strm_HTC = 2, 2, 0.400000E-01
Strm_GTF = 2, 2, 0
Strm_GT = 2, 2, 7.50000

Strm_TS = 3, 3, 332.000
Strm_TT = 3, 3, 91.0000
Strm_CP = 3, 3, 0.538000
Strm_HTC = 3, 3, 0.500000
Strm_GTF = 3, 3, 0
Strm_GT = 3, 3, 7.50000
Strm_TS = 3, 4, 91.0000
Strm_TT = 3, 4, 90.0000
Strm_CP = 3, 4, 0.538000
Strm_HTC = 3, 4, 0.500000
Strm_GTF = 3, 4, 0
Strm_GT = 3, 4, 7.50000

Strm_TS = 4, 5, 25.0000
Strm_TT = 4, 5, 128.000
Strm_CP = 4, 5, 0.933000
Strm_HTC = 4, 5, 0.100000E-01
Strm_GTF = 4, 5, 0
Strm_GT = 4, 5, 7.50000

Strm_TS = 5, 6, 118.000
Strm_TT = 5, 6, 265.000
Strm_CP = 5, 6, 1.96100
Strm_HTC = 5, 6, 0.500000
Strm_GTF = 5, 6, 0
Strm_GT = 5, 6, 7.50000

[### Stream Names]

Strm_Name = 1, STREAM 1
Strm_Name = 2, STREAM 2
Strm_Name = 3, STREAM 3
Strm_Name = 4, STREAM 4
Strm_Name = 5, STREAM 5

Full example file

2.0 [UMIST SDF Data File Version Number 02/11/1998 10:34:00]

[COUNTERS]
No_Strms = 5
No_Segs = 6
No_UtyStrms = 4
No_UtySegs = 4
No_StrmConst = 0

[DATA]
[### Project Description]
Proj_Descript = 1,
Proj_Descript = 2,
Proj_Descript = 3,

[### Stream Data]
Strm_TS = 1, 1, 159.000
Strm_TT = 1, 1, 77.0000
Strm_CP = 1, 1, 2.28500
Strm_HTC = 1, 1, 0.100000
Strm_GTF = 1, 1, 0
Strm_GT = 1, 1, 7.50000

Strm_TS = 2, 2, 267.000
Strm_TT = 2, 2, 80.0000
Strm_CP = 2, 2, 0.204000
Strm_HTC = 2, 2, 0.400000E-01
Strm_GTF = 2, 2, 0
Strm_GT = 2, 2, 7.50000

Strm_TS = 3, 3, 332.000
Strm_TT = 3, 3, 91.0000
Strm_CP = 3, 3, 0.538000
Strm_HTC = 3, 3, 0.500000
Strm_GTF = 3, 3, 0
Strm_GT = 3, 3, 7.50000
Strm_TS = 3, 4, 91.0000
Strm_TT = 3, 4, 90.0000
Strm_CP = 3, 4, 0.538000
Strm_HTC = 3, 4, 0.500000
Strm_GTF = 3, 4, 0
Strm_GT = 3, 4, 7.50000

Strm_TS = 4, 5, 25.0000

Strm_TT = 4, 5, 128.000
Strm_CP = 4, 5, 0.933000
Strm_HTC = 4, 5, 0.100000E-01
Strm_GTF = 4, 5, 0
Strm_GT = 4, 5, 7.50000

Strm_TS = 5, 6, 118.000
Strm_TT = 5, 6, 265.000
Strm_CP = 5, 6, 1.96100
Strm_HTC = 5, 6, 0.500000
Strm_GTF = 5, 6, 0
Strm_GT = 5, 6, 7.50000

[### Stream Names]
Strm_Name = 1, STREAM 1
Strm_Name = 2, STREAM 2
Strm_Name = 3, STREAM 3
Strm_Name = 4, STREAM 4
Strm_Name = 5, STREAM 5

[### Utility Data]
UtyStrm_TS = 1, 1, 250.000
UtyStrm_TT = 1, 1, 249.900
UtyStrm_CPR = 1, 1, 1.00000
UtyStrm_HTC = 1, 1, 50.0000
UtyStrm_GTF = 1, 1, 0
UtyStrm_GT = 1, 1, 0.000000E+00

UtyStrm_TS = 2, 2, 200.000
UtyStrm_TT = 2, 2, 199.900
UtyStrm_CPR = 2, 2, 1.00000
UtyStrm_HTC = 2, 2, 50.0000
UtyStrm_GTF = 2, 2, 0
UtyStrm_GT = 2, 2, 0.000000E+00

UtyStrm_TS = 3, 3, 500.000
UtyStrm_TT = 3, 3, 160.000
UtyStrm_CPR = 3, 3, 1.00000
UtyStrm_HTC = 3, 3, 20.0000
UtyStrm_GTF = 3, 3, 0
UtyStrm_GT = 3, 3, 0.000000E+00

UtyStrm_TS = 4, 4, 20.0000
UtyStrm_TT = 4, 4, 60.0000
UtyStrm_CPR = 4, 4, 1.00000
UtyStrm_HTC = 4, 4, 200.000
UtyStrm_GTF = 4, 4, 0
UtyStrm_GT = 4, 4, 0.000000E+00
UtyStrm_ON_F = 1, 1
UtyStrm_ON_F = 2, 1
UtyStrm_ON_F = 3, 1
UtyStrm_ON_F = 4, 1
UtyStrm_Cost = 1, 250.000

UtyStrm_Cost = 2, 150.000
UtyStrm_Cost = 3, 300.000
UtyStrm_Cost = 4, 15.0000
UtyStrm_link = 1, 0, 0.000000E+00
UtyStrm_link = 2, 0, 0.000000E+00
UtyStrm_link = 3, 0, 0.000000E+00
UtyStrm_link = 4, 0, 0.000000E+00
UtyStrm_Min_Load = 1, 0, 0.000000E+00
UtyStrm_Max_Load = 1, 0, 0.000000E+00
UtyStrm_Min_Load = 2, 0, 0.000000E+00
UtyStrm_Max_Load = 2, 0, 0.000000E+00
UtyStrm_Min_Load = 3, 0, 0.000000E+00
UtyStrm_Max_Load = 3, 0, 0.000000E+00
UtyStrm_Min_Load = 4, 0, 0.000000E+00
UtyStrm_Max_Load = 4, 0, 0.000000E+00
UtyStrm_Exist_Load = 1, 0.000000E+00
UtyStrm_Exist_Load = 2, 0.000000E+00
UtyStrm_Exist_Load = 3, 0.000000E+00
UtyStrm_Exist_Load = 4, 0.000000E+00
Uty_CapCst = 1, 0.000000E+00, 0.000000E+00, 0.000000E+00
Uty_CapCst = 2, 0.000000E+00, 0.000000E+00, 0.000000E+00
Uty_CapCst = 3, 0.000000E+00, 0.000000E+00, 0.000000E+00
Uty_CapCst = 4, 0.000000E+00, 0.000000E+00, 0.000000E+00

[### Utility Stream Names]
UtyStrm_Name = 1, HP STEAM
UtyStrm_Name = 2, MP STEAM
UtyStrm_Name = 3, Flue GAS
UtyStrm_Name = 4, CW

[### Utility Emission Data]
UtyStrm_Emiss_Term = 1, 1, 1
UtyStrm_Emiss_Term = 1, 2, 2
UtyStrm_Emiss_Term = 1, 3, 3396.00
UtyStrm_Emiss_Term = 1, 4, 2830.00
UtyStrm_Emiss_Term = 1, 5, 1744.00
UtyStrm_Emiss_Term = 1, 6, 1800.00
UtyStrm_Emiss_Term = 1, 7, 160.000
UtyStrm_Emiss_Term = 1, 8, 86.2000
UtyStrm_Emiss_Term = 1, 9, 0.390000
UtyStrm_Emiss_Term = 1, 10, 42000.0
UtyStrm_Emiss_Term = 1, 11, 400.000
UtyStrm_Emiss_Term = 1, 12, 0.575000
UtyStrm_Emiss_Term = 2, 1, 1
UtyStrm_Emiss_Term = 2, 2, 2
UtyStrm_Emiss_Term = 2, 3, 3396.00
UtyStrm_Emiss_Term = 2, 4, 2760.00
UtyStrm_Emiss_Term = 2, 5, 2054.00
UtyStrm_Emiss_Term = 2, 6, 1800.00
UtyStrm_Emiss_Term = 2, 7, 160.000
UtyStrm_Emiss_Term = 2, 8, 86.2000
UtyStrm_Emiss_Term = 2, 9, 0.390000
UtyStrm_Emiss_Term = 2, 10, 42000.0

UtyStrm_Emiss_Term = 2, 11, 400.000
UtyStrm_Emiss_Term = 2, 12, 0.575000
UtyStrm_Emiss_Term = 3, 1, 1
UtyStrm_Emiss_Term = 3, 2, 1
UtyStrm_Emiss_Term = 3, 3, 86.2000
UtyStrm_Emiss_Term = 3, 4, 0.390000
UtyStrm_Emiss_Term = 3, 5, 42000.0
UtyStrm_Emiss_Term = 3, 6, 400.000
UtyStrm_Emiss_Term = 3, 7, 0.575000
UtyStrm_Emiss_Term = 4, 1, 0

[### Central Power emissions]
UtyStrm_Emiss_Term = 5, 1, 1
UtyStrm_Emiss_Term = 5, 2, 5
UtyStrm_Emiss_Term = 5, 3, 10.0000
UtyStrm_Emiss_Term = 5, 4, 0.280000
UtyStrm_Emiss_Term = 5, 5, 86.2000
UtyStrm_Emiss_Term = 5, 6, 0.390000
UtyStrm_Emiss_Term = 5, 7, 42000.0
UtyStrm_Emiss_Term = 5, 8, 400.000
UtyStrm_Emiss_Term = 5, 9, 0.575000

[### Economic Data]
HX_Cap_Cost = 1, 380.000 , 750.000 , 0.830000
Economic_Method = 1
Plant_life = 6.00000
Rate_of_Interest = 10.0000
Operating_Hours = 8000.00
Existing_Area = 0.000000E+00

[### Settings]
Recovery_Spec = 1
Spec_DTmin = 15.0000
Spec_HotUty = 0.000000E+00
Spec_ColdUty = 0.000000E+00
X12_Shells = 0.900000
Shell_Max_Area = 1000.00
Temperature_Scale = 1
Ambient_Temperature = 25.0000
Exergetic_Eff = 0.700000
DTmin_APP = 10.0000

[### Units text]
UTX_Temperature = C , 1
UTX_Pressure = Bar , 1.00000
UTX_Pressure_Type = Gauge, 1
UTX_CP = kW/C , 1.00000
UTX_DH = kW , 1.00000
UTX_HTC = kW/C.m^2 , 1.00000
UTX_Area = m^2 , 1.00000
UTX_Length = m , 1.00000
UTX_Shells = N , 1.00000
UTX_Currency = £ , 1.00000

UTX_Ann_Cost = £/yr , 1.00000
UTX_Unit_Cost = £/kW.yr , 1.00000
UTX_Time = hr , 1.00000
UTX_Null = - , 1.00000
UTX_Concentration = ppm , 1.00000
UTX_MassFlow = t/hr , 1.00000
UTX_MassFlow2 = g/hr , 1.00000
UTX_Len_Cost = £/m , 1.00000
UTX_MolarFlow = kMol/S , 1.00000
UTX_Flow_Cost = £/t , 1.00000
UTX_StmUse_Flow = kg/t , 1.00000
UTX_PwrUse_Flow = kWh/t , 1.00000
UTX_CWUse_Flow = t/t , 1.00000
UTX_FuelUse_Flow = kW/t , 1.00000
UTX_Stm_Cost = £/kg , 1.00000
UTX_Pwr_Cost = £/kWh , 1.00000
UTX_CW_Cost = £/t , 1.00000
UTX_Fuel_Cost = £/kW , 1.00000
UTX_H2_Gas_Rate = kg/t , 1.00000
UTX_Volumetric_Flowrate = m^3/s , 1.00000
UTX_Volume = m^3 , 1.00000
UTX_Molar_Concentration = kmol/m^3 , 1.00000
[EOF]